RANGE-WIDE STATUS ASSESSMENT FOR YELLOWSTONE CUTTHROAT TROUT (*ONCORHYNCHUS CLARKII BOUVIERI*): 2012

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Executive Summary

The status of Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) across their historical range was initially assessed in 1995, and updated in 2001 and 2006. Here we summarize their status in 2011, and report on changes since the 2006 report (May et al. 2007). The 2011 analyses reflect data added or revised beginning January 1, 2007, and ending on December 31, 2011. A relational database linked to a geographic information system (GIS) stores all the data that were used to display maps and summarize data in tables and figures. During this update, we added a listing of conservation actions that have been undertaken from 2000 through 2011, which are also included in the database.

Yellowstone cutthroat trout historically occupied about 61 lakes. At 96,000 surface acres, Yellowstone Lake accounted for about 78% of the surface area of all lakes historically occupied by Yellowstone cutthroat trout. By the 2011 assessment, Yellowstone cutthroat trout occupied 232 lakes having a total surface area of about 350,360 acres. Many of the additional lakes occupied in 2011 are high mountain lakes that were probably not historically occupied, and some of these lakes are managed as recreational fisheries.

Historically, Yellowstone cutthroat trout occupied about 17,800 miles of stream and river habitat. In the 2006 and 2011 assessments, designated conservation populations occurred in over 7,500 miles or about 43% of the historically occupied lotic environments. Yellowstone cutthroat trout core conservation populations – defined as those populations that have no evidence of genetic introgression with nonnative species (hybridization) or are likely not hybridized - occupied an estimated 23% (4,863 miles) of historical habitat. Genetic testing has not been completed for suspected core Yellowstone cutthroat trout populations that occupy about 1,700 miles of river and stream habitat. Mixed-stock Yellowstone cutthroat trout populations, which exist in sympatry with potentially hybridizing species, occupy about 2,176 miles of stream.

Generally, changes between estimates of distribution of Yellowstone cutthroat trout between the 2006 and 2011 assessments analyses were less than 2%. Although a few Yellowstone cutthroat trout populations were extirpated during this period, these losses were off-set by restoration efforts that expanded the distribution of existing populations, or reestablished, through introductions, populations within their historical range. Additional sampling following 2006 and through 2011 discovered several new Yellowstone cutthroat trout populations, with no evidence of genetic hybridization. Conversely, some Yellowstone cutthroat trout populations that previously had no evidence of genetic hybridization were found to contain some level of genetic hybridization during this period.

Collaborative conservation of Yellowstone cutthroat trout occurred within four primary geographic management units (GMUs) within their historical range. Since 2000, partners have implemented over 280 conservation projects for Yellowstone cutthroat trout. Projects varied in scope and specific actions; however, most were focused on improving and connecting habitat, increasing flows, restoring populations, and protecting populations with barriers. The status of Yellowstone cutthroat trout has remained relatively constant from 1995 through 2011, primarily due to the level of collaborative efforts that have been expended to survey, protect, and restore Yellowstone cutthroat trout populations, off-setting local extirpations and expansion of genetic hybridization.

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FWP	Montana Fish, Wildlife & Parks
GIS	Geographic information system
GMU	Geographic management unit
HUC	Hydrological unit code
NHD	National hydrological database

1.0 Introduction

This 5-year status assessment for Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) is the fourth iteration of status assessments that began in the 1990s, and continued in 2001 and 2006 (May 1996; May et al. 2003; May et al. 2007). The previous assessment (May et al. 2007) was the most comprehensive, rectifying many of the limitations of earlier versions, and encompassed data amassed to December 31, 2006. It provided a range-wide evaluation that integrated the historical and current distribution of Yellowstone cutthroat trout, delineated discrete populations of Yellowstone cutthroat trout, when possible, and identified opportunities for restoration or expansion of Yellowstone cutthroat trout populations.

The current assessment summarizes the data collected and corrections made to the database beginning in January 1, 2007 and ending December 31, 2011. New to the current assessment was management of information on multiple spatial scales. The lowest scale began with habitat features, such as a specific barrier. Next, the habitat segment scale classified a specific stream or lake. The watershed levels included two scales based on hydrologic units delineated by the U.S. Geological Survey (2013). This system delineates hydrologic units hierarchically, according to a numeric coding system that assigns a hydrologic unit code (HUC) and an associated term. The Yellowstone cutthroat trout status assessments typically use the 4th and 3rd code HUCs, which delineate subbasins and subregions, respectively. Geographical management units (GMUs) correspond with subregions under the HUC hierarchical scheme. The portions of the 3rd code HUCs that historically supported Yellowstone cutthroat trout are: the Yellowstone, Big Horn, Upper Snake, and Lower Snake subregions. Other scales include various administrative units, such as state or agency boundaries; and at the top of the scale is the range-wide perspective.

The protocol used by May et al. (2007) included a standardized approach for obtaining and applying information, resulting in a range-wide assessment of Yellowstone cutthroat trout. In developing their protocol, May et al. (2007) relied on local expertise, or specifically, the collective knowledge of professional biologists involved in conservation of Yellowstone cutthroat trout, as well as that of local tribes, to fine-tune the historical range and current distribution of Yellowstone cutthroat trout. These biologists validated previously identified conservation populations, evaluated the database for errors, and included newly identified conservation populations, thereby increasing the accuracy of the estimates of the status of the subspecies.

This document is a companion of the comprehensive 2006 assessment (May et al. 2007). Instead of replicating the extensive amount of information compiled for the 2006 status review, we describe changes in distribution, genetic status, and conservation status across historical range and within GMUs and provide the rationale for these changes when possible.

2.0 Analysis Area

The analysis area (Figure 2-1) includes the historical native range of Yellowstone cutthroat trout, as identified in May et al (2003). This area includes 39 4th-level HUCs within upper portions of the Yellowstone River drainage in Montana and Wyoming and the upper Snake River drainage in Idaho, Wyoming, Nevada, and Utah. These 4th-level HUCs vary in size from 436 to nearly 3,600 square miles, averaging 1,495 square miles (USGS 2002). The analysis area includes watersheds on the Pacific and Atlantic drainage sides of the Continental Divide that range in elevation from 2,690 to 13,809 feet.

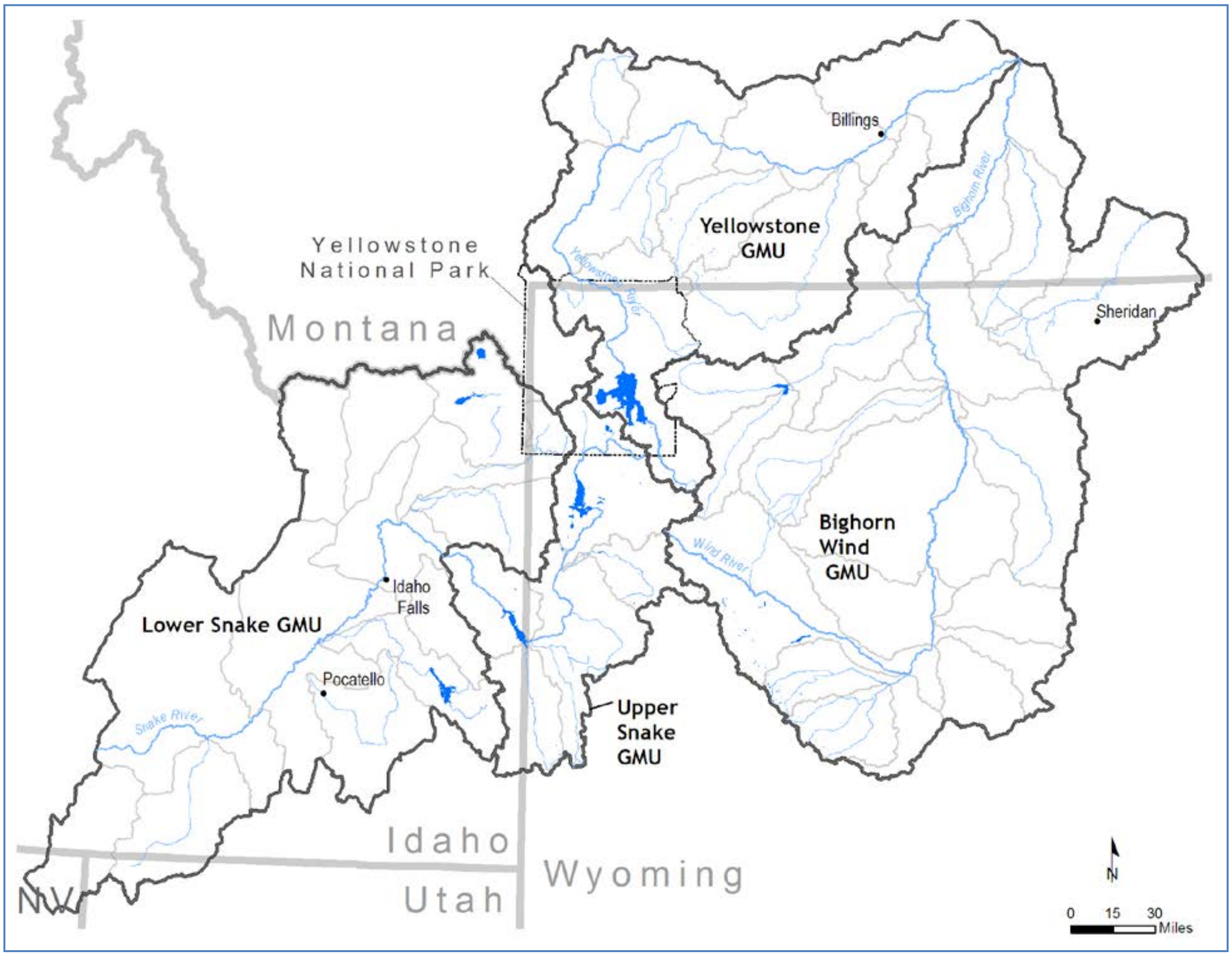

Figure 2-1. Study area with 3rd- and 4th-code HUCs and GMUs shown.

The Yellowstone cutthroat trout's native range is a mosaic of federal, state, private, and tribal lands. Most of the high-elevation portions are within national forest or Yellowstone National Park (YNP). Logging, mining, and livestock grazing are the primary land uses in the higher elevations outside of YNP. Angling is popular in fishable waters. Lower elevations are mostly private lands, but include state, federal and tribal lands. Here, agriculture is the principal land use, with livestock and associated forage production, and cultivation of small grains and potatoes occurring over most of the valley landscapes. Energy development, including traditional oil and gas, as well as wind energy, occurs at discrete locations throughout the analysis area. Urbanization is scattered, occupying a small portion of total land use. Billings, Montana is the largest city, with a population of over 100,000. Idaho Falls, Idaho is the next largest city, with over 8,000 people. Otherwise, most small towns have populations of fewer than 8,000 people. Agricultural lands are sparsely populated, with residences scattered across relatively large tracts.

3.0 Methods

3.1 Geographic Information System (GIS)

A GIS is a computer program designed to store, manage, analyze, and present spatial data. This update used GIS tools in ArcView 9.3™, as well as a relational database within Microsoft Access™, to organize and display spatially explicit stream, lake, and fish distribution data as well as habitat restoration activities. In summarizing those data, we chose to use stream and river distances and population counts as measures of Yellowstone cutthroat trout occupancy, both for suspected historical and known currently occupied habitats. GMU boundaries, or 3rd-code HUCs, were the primary unit for organizing these data.

Only perennial streams and lakes identified on the National Hydrologic Data (NHD) data set were entered into the database. Although intermittent and ephemeral streams may provide habitat for Yellowstone cutthroat trout during specific times, they were not included in this effort because of a need to maintain consistency among locations. Due to inconsistencies in the NHD, some perennial streams may not have been included in this assessment. We plan to include these streams in future assessments after they have been added to the NHD. Due to the above protocol decisions and NHD stream layer limitations, our assessment likely provides a conservative estimate of distribution of Yellowstone cutthroat trout.

3.2 Updates, Database Maintenance, and Summaries

This status assessment followed a standardized approach with protocols comparable to those used in 2006 (May et al. 2007). The analyses reflect data added to, or corrected in, the database from January 1, 2007 to December 31, 2011. Annually, local biologists provided data and associated information to GMU leaders. Data quality varied from professional judgment to intensive aquatic sampling. The sampling schemes were not random, nor were the data from an independent source; therefore, the information is not free of bias. To aid in interpretation of the data, biologists characterized the quality of each data collection method by including a citation, or by applying a rating system to the information source. This approach allowed us to assign a data quality category (professional judgment versus detailed field observation and fish sampling) to each data set, which then allowed us to evaluate the certainty of the fisheries composition and to assess whether field sampling would be needed to decrease uncertainty in a particular stream or lake. Completed habitat actions were also identified and incorporated into the database.

To maintain consistency in application of the protocol, a single contact person within each GMU was assigned to work directly with a GIS/database specialist at Montana Fish, Wildlife & Parks (FWP). The database specialist also worked directly with GMU leaders to modify the database, answer questions, and help solve disparities. After changes were made to the geo-database, annual changes were posted in an interactive web-mapping application for review and approval. Annual updates to this interactive mapper displayed existing and proposed changes to data.

Queries built in the Microsoft Access geo-database summarized data provided by fishery professionals. The geo-database contains 4 components. The historical component delineates waters believed to have been occupied by Yellowstone cutthroat trout at the time of the first exploration of the Northern Rocky Mountains by people of European descent. Current distribution of Yellowstone cutthroat trout in specified habitat segments is the second component, and includes data on the attributes of each habitat segment (e.g., the characteristics of the body of water, fish density, fish stocking history, presence of nonnative species, and attributes of the Yellowstone cutthroat trout within the habitat segment, such as spotting pattern and genetic status). The third component is reevaluation of previously identified conservation populations and the identification of new populations. The fourth component evaluated opportunities for restoration or expansion of conservation populations within the historical range of the Yellowstone cutthroat trout.

Several changes to the database occurred for the current update. These included normalizing the database tables, and adding editor tracking fields to each table. The tracking fields added were date modified, editor, and justification for the edit. These additions allow evaluation of how current data differ from the previous year’s data.

We also added new information on the conservation populations to the third component of the geo-database. Genetic or conservation status was inferred by known or potential reproductive interaction within a group of Yellowstone cutthroat trout occupying either an individual stream or lake, or a network of connected bodies of water. For each identified conservation population, the reproductive interaction had to be two-directional, resulting in upstream and downstream exchange of genes.

Evaluation of several parameters provided the basis to make inference on potential changes in conservation status in the 2006 assessment and the 2011 assessment (Table 3-1). These analyses were calculated for the historic, range-wide distribution of Yellowstone cutthroat trout, and for each GMU.

Table 3-1. Parameters used to evaluate changes conservation status in the 2006 and 2011 assessments.

Parameter	Description
Historical distribution	Estimated stream miles, number and acres of lakes
Current distribution	Estimated occupancy or extirpation among habitat types
Genetic distribution and status	Estimated categories of genetic status across habitats
Conservation population status	Estimated number of populations and stream miles currently occupied by conservation populations
Conservation population qualifier	Estimate of the extent of habitat occupied by core populations, those with unique life histories or adaptations, predisposition for large size and populations likely to become the focus of conservation actions.
Hybrid risk of conservation populations	Estimated risk of hybridization based on sympatry with hybridizing species, and proximity of hybrid species to conservation populations
Connectivity	Estimated number of populations and stream miles ranking as moderately networked, isolated, strongly networked, weakly networked, and unknown.
Conservation population qualifier	Estimates of the extent of habitat occupied by core populations, those with unique life histories or adaptations, predisposition for large size and populations likely to become the focus of conservation actions.
Number of barriers	Estimated number of barriers, and categorization of whether the barriers are complete, partial, historically present in the currently occupied habitat, and currently present in the current distribution
Barrier Quality	Assessment of the quality of information used in determining the effectiveness of a feature as a fish barrier
Density	Estimated density of Yellowstone cutthroat trout in 5 categories ranging from unknown to 1,001 to 2,000 fish per mile

We included data on the relative health of all populations that occupied stream habitat, with risks of genetic hybridization and disease being determinants of health. Health and risk ratings were intended to represent relative conditions, indicating higher or lower levels of concern. Yellowstone cutthroat trout populations supported entirely by annual or routine stocking were not included as part of the current distribution or conservation population evaluations. The only exception was for Yellowstone cutthroat trout serving as wild broods that might require periodic stocking to bring in new genetic material as part of a brood maintenance program.

4.0 Results and Discussion

4.1 Range-Wide

Historically, Yellowstone cutthroat trout were native in 5 states (May 2003): Wyoming, Idaho, Montana, Nevada, and Utah (Figure 4-1) with wide distribution in streams throughout Wyoming, Idaho, and Montana. The southernmost portion of their range dipped into northern Utah and Nevada, and accounted for a minute fraction of their historical distribution, and a few conservation populations remain in these states.

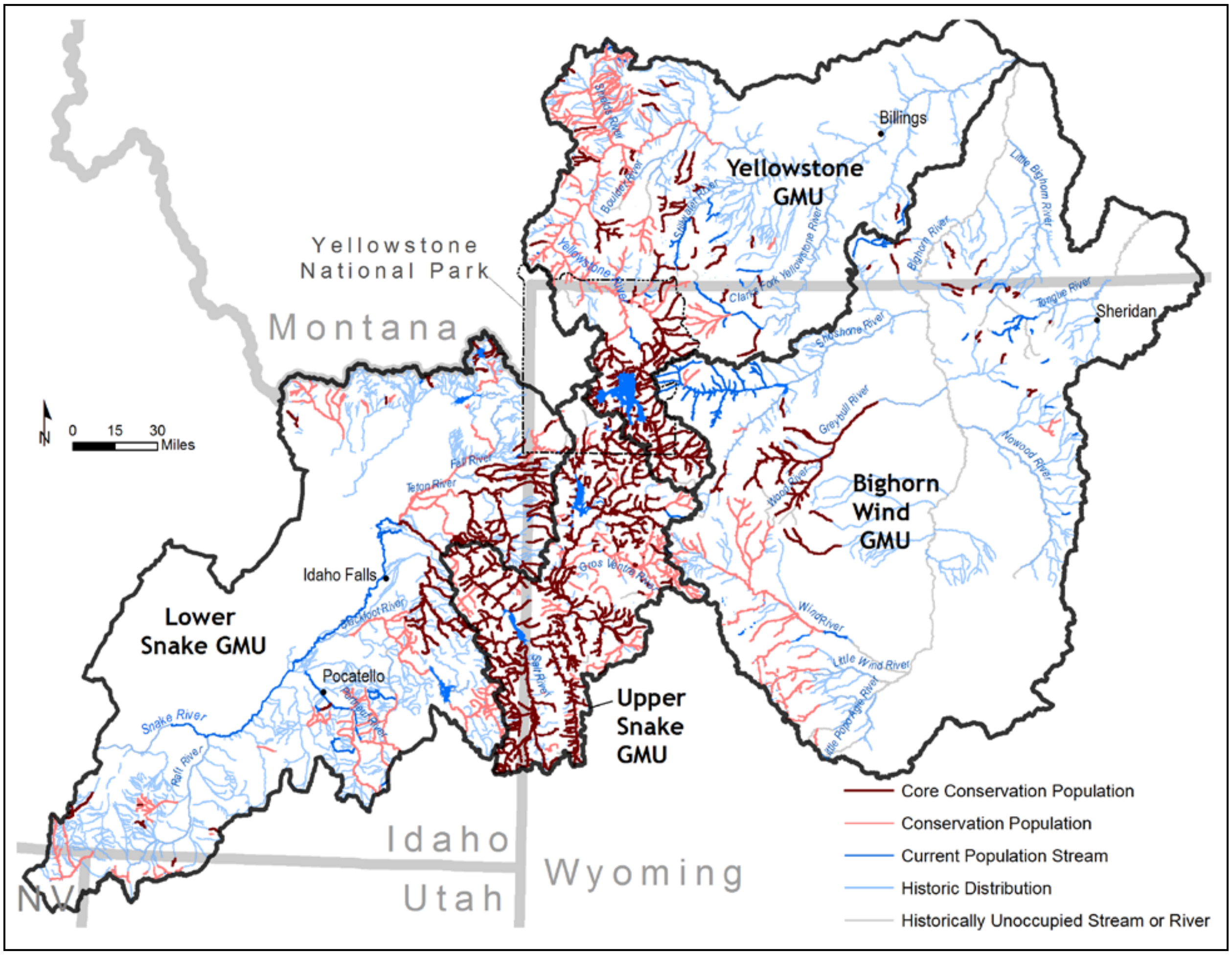

Figure 4-1**.** Distribution of Yellowstone cutthroat trout historically and in 2011.

The number of stream miles with Yellowstone cutthroat trout was substantial, with about 17,800 miles occupied in the early 1800s (Table 4-1). Historically, about 61 lakes likely supported a Yellowstone cutthroat trout population. Lakes are not common natural features in valley portions of the historical range. Most of the lakes are montane cirques, formed by mountain glaciers.

Cirques were mostly inaccessible to trout due to natural barriers, such as waterfalls or steep cascades. The historical acreage of lakes supporting Yellowstone cutthroat trout was disproportionate to the number of lakes, largely due to the size of Yellowstone Lake, which has a surface area of nearly 90,000 acres. Yellowstone Lake accounts for nearly 78% of the historically occupied lentic habitat.

Table 4-1: Comparison of estimates of the historical habitat of Yellowstone cutthroat trout circa 1800 in the 2006 and 2011 assessments.

Estimates of Historical Distribution	2006	2011
Miles of stream	17,739	17,807
Number of lakes	61	61
Acres of lakes	125,716	125,716

Changes in reported metrics in the 2011 assessment could be the result of conservation actions, invasion of nonnative species, or other phenomena within the landscape, as well as field investigations that have refined our knowledge of distribution, genetic status, or risks. Corrections to the database were also a substantial, and resulted in changes to numerous parameters across GMUs. The subsequent chapters addressing smaller spatial scales will shed light on the reasons for changes.

Yellowstone cutthroat trout have decreased in abundance and distribution within their historical range. The pattern of extirpation is a retraction of Yellowstone cutthroat trout toward the center of their historical distribution, with isolated populations remaining on the fringes (Figure 4-1). These isolated populations are at higher risk of extirpation, because they cannot be replaced through recolonization from a nearby population after a catastrophic event, and because small population size puts these fish at risk of inbreeding depression.

Minor changes occurred in the current number of Yellowstone cutthroat trout populations, and the spatial extent of their distribution, from the 2006 assessment to the 2011 assessment (Table 4-2). The number of populations decreased by 9, but the number of miles of occupied streams increased slightly by 65. Despite, the decreases in population numbers, and increases in stream miles, the percent of historical habitat still occupied by Yellowstone cutthroat trout remained at 43%. The number of populations no longer present declined by 11, suggesting restoration of populations to previously occupied streams, or identification of new populations. These efforts resulted in an increase of 34 miles of occupied habitat. The number of occupied lakes increased by 27, owing to introductions into previously unoccupied lakes, or identification of previously unknown populations. Likewise, the acreage of occupied lakes expanded by 400 acres, with corrections to the database due to the increase in acreage.

Table 4-2**.** Comparisons of number of Yellowstone cutthroat trout populations and spatial extent of Yellowstone cutthroat trout occupancy in the 2006 and 2011 assessments.

Estimates	2006	2011	Extent of Change (numbers, miles, or acres)
Number of populations	1,018	1,009	-9
Miles of stream occupied by conservations populations	7,527	7,592	65
% of historical stream miles occupied	43%	43%	0
Number of populations no longer present	44	33	-11
Miles of stream no longer occupied	188	154	-34
Number of recreational populations	20	19	-1
Miles of stream occupied by recreational populations	201	304	103
Number of lakes currently occupied	205	232	27
Acres of lakes currently occupied	349,962	350, 362	400
Current, recreation and no longer present (miles)	7,916	8,050	134

Following the 2006 assessment, 80 miles of new stream reaches were sampled for genetics, and the analysis resulted in a number of changes in the understanding of genetic status (Table 4-3). Nine new unaltered populations were found, with 46 miles of habitat supporting nonhybridized Yellowstone cutthroat trout. However, 34 miles of sampled stream were found to be genetically altered, which slightly increased the stream miles known to support hybridized fish.

Table 4-3. Comparisons of genetic testing and genetic status of Yellowstone cutthroat trout in the 2006 and 2011 assessments.

Genetics of Current Populations	2006	2011	Extent of Change (numbers, miles, or acres)
Populations tested, unaltered	397	406	9
Stream miles with genetic testing	3,883	3,963	80
% of current distribution that has been tested	42%	52%	10%
Stream miles with genetically unaltered, tested	3,112	3,158	46
Stream miles with genetically altered, tested	771	805	34
Stream miles presumed genetically unaltered, untested	1,854	1,705	-149
Lakes with genetic testing	12	13	1
Lakes without genetic testing	193	219	26
Lakes tested, unaltered	9	9	0
Lakes presumed unaltered, untested	154	169	15

Efforts to collect data on previously un-sampled streams extended the knowledge of genetic status of Yellowstone cutthroat trout (Table 4-3). In the 2006 assessment, nearly 1,900 miles of stream presumed to support genetically altered fish remained untested. During the intervening years, genetic testing reduced this number of stream miles by about 150 miles.

Yellowstone Lake provides supports the largest adfluvial Yellowstone cutthroat trout population. Most of the other lake populations were introduced into previously fishless waters. Nonetheless, these other lake populations provide potential donor populations and recreational opportunities. Testing in lakes has not been as extensive as stream investigations (Table 4-3). Genetic testing occurred on 1 lake following 2006. The number of lakes without genetic testing increased from 193 to 219. This increase is likely the result of identification of additional lakes supporting Yellowstone cutthroat trout. As the majority of lakes inhabited by Yellowstone cutthroat trout support introduced populations, they have less priority for genetic testing, unless they have potential to contribute fish to streams with conservation populations of Yellowstone cutthroat trout.

Conservation populations are those with less than 10% hybridization. Protecting Yellowstone cutthroat trout conservation populations is a high priority among all states (May 2000). The 2011 assessment showed 2 additional conservation populations occupying 31 miles of stream (Table 4-4).

Table 4-4. Comparisons of number of conservation populations of Yellowstone cutthroat trout and stream miles occupied by conservation populations in the 2006 and 2011 assessments.

Estimates	2006	2011	Extent of Change (numbers, miles, or acres)
Number of conservation populations	306	308	2
Miles of stream occupied by conservation populations	7,204	7,235	31

The extent of hybridization, diversity of life-history strategies, unique adaptations, and potential for large fish are conservation population qualifiers (Table 4-5) that affect the conservation value of a population, and guide prioritization of implementing conservation actions. The first qualifier addresses core populations, which are those with less than 1% hybridization with rainbow trout or westslope cutthroat trout. Protection and reestablishment of these populations, especially the unaltered ones, is the highest conservation priority (May 2000).

Table 4-5. Comparison of conservation population qualifiers in the 2006 and 2011 assessments.

Estimates	2006	2011	Extent of Change (numbers, miles, or acres)
Number of core populations	137	155	18
Stream miles occupied by core populations	4,069	4,047	-22
Number of populations with unique life history strategies	81	65	-16
Stream miles occupied by populations with unique life history strategies	1,970	1,725	-245
Number of populations with unique adaptations	3	3	0
Number of populations with predisposition for large size	2	2	0
Number of populations likely to be the focus of conservation actions	82	65	-17

Estimates of the number of core populations increased by 18 in the 2011 assessment (Table 4-5). At the range-wide scale, the cause of this increase is unclear. It could be the result of identification of existing core populations or establishment of new core populations. Despite the increase in the number of core populations, the number of stream miles occupied by core populations decreased from 4,069 to 4,047. Alarmingly, the reassessment identified reductions in the number and stream miles occupied by unique life-history strategies. These reductions could relate to loss of fluvial or adfluvial populations, which rank high in conservation prioritization (May 2000). Possible opportunities to reverse this trend will be evaluated at smaller spatial scales. Otherwise, populations with unique adaptations or a predisposition for large size remained unchanged. The number of populations likely to be the focus of conservation actions decreased by 17 or 20%. At the range-wide scale, the justification for this decrease is unclear.

Hybridization is the greatest cause for the decline of Yellowstone cutthroat trout (Kruse et al. 2000). Rainbow trout are the primary threat; however, westslope cutthroat trout also interbreed with Yellowstone cutthroat trout. An apparent change in risk of hybridization between the 2006 and 2011 assessments (Table 4-6) suggests that invasion of nonnatives has occurred within the historical range of Yellowstone cutthroat trout. However, these changes may be artifacts of fisheries investigations following the 2006 assessment. The number of populations with no risk of hybridization decreased by 6, and the number of stream miles with no risk decreased by 32 miles. The number of populations sympatric with rainbow trout or westslope cutthroat trout dropped from 30 to 28; however, the number of stream miles with risk of hybridization was unchanged. A potential decrease in populations that were < 6 miles from hybridizing species may also relate to a 224-mile decrease in streams < 6 miles from hybridizing species. The number of populations > 6 miles from hybridizing species remained unchanged, while the number of stream miles with hybridizing species > 6 miles away increased by over 90.

Table 4-6. Comparisons of risk of hybridization of conservation populations in the 2006 and 2011 assessments in the currently occupied range of Yellowstone cutthroat trout.

Estimates	2006	2011	Extent of Change (numbers, miles, or acres)
Number of populations with no risk of hybridization	123	117	-6
Number of stream miles with no risk of hybridization	1,495	1,463	-32
Number of populations sympatric with hybridizing species	30	28	-2
Number of stream miles sympatric with hybridizing species	2,175	2,176	1
Number of populations with hybridizing species < 6 miles of stream from the population	90	86	-4
Miles of stream with conservation populations < 6 miles from hybridizing species	2,155	1,931	-224
Number of populations > 6 miles from hybridizing species	63	63	0
Miles of stream > 6 miles from hybridizing species	1,380	1,471	91
Number of populations where sympatry with hybridizing species is unknown	0	12	12
Miles of stream where sympatry with hybridizing species is unknown	0	194	194

Connectivity and isolation changed between the 2006 and 2011 assessments (Table 4-7). The number of moderately networked populations increased, but the number of miles of moderately connected habitat decreased by 86 miles. Similarly, the number of isolated populations decreased by 12, yet the number of isolated stream miles increased by almost 50 miles. This apparent disparity could be related to a combination of the removal of passage barriers to promote fish movement, and concomitant construction of passage barriers to protect or reestablish core populations. Weakly networked populations and streams were relatively similar in the 2006 2011 assessments. Discussion of specific conservation actions should shed light on changes during the 5-year period.

Table 4-7. Comparison of connectivity of Yellowstone cutthroat trout populations in the 2006 and 2011 assessments.

Estimates	2006	2011	Extent of Change (numbers, miles, or acres)
Number of moderately connected populations	34	37	3
Number of miles of moderately connected, occupied streams	1,347	1,261	-86
Number of isolated populations	188	176	-12
Number of stream miles occupied by isolated populations	813	860	47
Number of strongly networked streams	36	42	6
Miles of strongly networked streams	4,454	4,539	85
Number of populations with unknown connectivity	0	3	3
Number of stream miles with unknown connectivity	0	8	8
Number of weakly networked populations	48	49	1
Number of stream miles with weakly networked populations	590	567	-23

Barriers to fish movement include natural features, such as waterfalls or lengthy cascades, or relate to human activities, such as culverts at road crossings or irrigation diversions. Changes in the numbers of barriers may be the result of searches for barriers or deliberate construction of protective barriers. Since 2000, 9 barriers were intentionally constructed to protect core or conservation populations of Yellowstone cutthroat trout. The number of known barriers (Table 4-8) increased substantially, with identification of an additional 121 barriers. An additional 80 known complete barriers were located or constructed from between assessments. The number of identified partial barriers also increased from 207 to 229. Although barrier counts increased between assessments, the number of complete barriers considered present historically decreased. This change may be the result of removal of natural barriers to increase available habitat, evaluation of the ability of previously identified barriers to block fish movements, or finding fish upstream of features that had formerly been considered to be a barrier.

Table 4-8. Comparison of known barriers in the 2006 and 2011 assessments in the currently occupied range of Yellowstone cutthroat trout.

Estimates	2006	2011	Change in Number of Barriers
Number of barriers	902	1,023	121
Number of complete barriers	638	718	80
Number of partial barriers	207	229	22
Number of complete barriers considered to be present in the historical range	419	378	-41
Number of complete barrier in currently occupied range	219	340	121

An increase in field sampling after 2006 provided improved analysis on whether specific barriers provided an obstacle to fish (Table 4-9). Efforts varied in their rigor. Methods to determine the ability of a barrier to block fish passage include fish sampling upstream of a barrier, genetic investigations, visual inspection, or anecdotal information. In some cases, modeling can determine whether a feature is a velocity or jump barrier to fish. Intensive efforts to identify barriers and evaluate their ability to block fish documented an additional 65 barriers with high certainty on whether fish could gain access over the barrier. Less intensive efforts identified an additional 32 barriers that possibly block fish. Simple visual inspection of barriers found increased the number of barriers identified by this method to 23. Anecdotal information increased the number of potential barriers by 1.

Table 4-9. Comparison of quality of information allowing inference of the ability of barriers to block fish passage in the 2006 and 2011 assessments in the currently occupied range of Yellowstone cutthroat trout.

Estimate	2006	2011	Change in Number of Barriers
Number of barriers with major evaluation of potential for fish passage	520	585	65
Number of barriers with medium evaluation of potential for fish passage	103	135	32
Number of barriers with ocular estimates of potential for fish passage	155	178	23
Number of barriers with anecdotal information	124	125	1
TOTAL	902	1023	121

Comparisons of estimated densities of Yellowstone cutthroat trout per mile varied among categories (Table 4-10). Mostly, estimated densities in terms of fish per mile increased slightly. The exception was the 151 to 2,000 fish per mile category, which decreased slightly. The number of miles with unknown densities of fish decreased 87 miles, which likely reflects extensive sampling efforts occurring within the assessment period.

Variability in stream size, gear and capture efficiency of fish of different sizes is a confounding factor in determining fish density. For example, boat mounted electrofishing in the Yellowstone River in Montana is inefficient in capturing small fish, and population estimates count fish 7 inches or greater. Backpack electrofishing in smaller streams is more efficient in capturing small fish, including age-1 fish. Despite the bias towards capturing and counting larger fish in riverine environments, these larger waters provide more habitat, and support greater densities of fish than smaller streams.

Table 4-10. Comparison of Yellowstone cutthroat trout densities per mile in the 2006 and 2011 assessments in the currently occupied range of Yellowstone cutthroat trout .

Estimates	2006	2011	Change in Miles
0 to 50 fish/mile	2,725	2,911	186
51 to 150 fish/mile	2,057	2,191	134
151 to 2,000 fish / mile	2,539	2,435	-104
1,001 to 2,000 fish / mile	106	114	8
Unknown	605	518	-87
TOTAL	8,032	8,169	137

The range-wide assessment scale provides a broad overview of the changes of numerous parameters providing information on the status of Yellowstone cutthroat trout and makes comparisons of these measures between the 2006 and 2011 assessments. As the range-wide scale is the most expansive view possible, drawing inference on the causes and biological significance of changes is difficult. The subsequent chapters address changes at the smaller scales and identify conservation actions, invasions, field investigations, or other events that affect our understanding of the conservation status of Yellowstone cutthroat trout.

4.2 Bighorn Wind GMU

The Bighorn Wind GMU (Figure 4-2) begins in the Wind River Mountains near Dubois, Wyoming, as the Wind River drainage, and changes to the Bighorn River at Weddings of the Waters in the Wind River Canyon, several miles south of Thermopolis, Wyoming. The GMU terminates at the confluence of the Bighorn River and Yellowstone River, north of Custer, Montana, and encompasses all waters within the 2nd level HUC 1008. The upper Tongue watershed (10090101) is also included in this GMU and represents the easternmost distribution of Yellowstone cutthroat trout. The Bighorn Wind GMU includes 17 4th level HUCs, with only four not containing Yellowstone cutthroat trout.

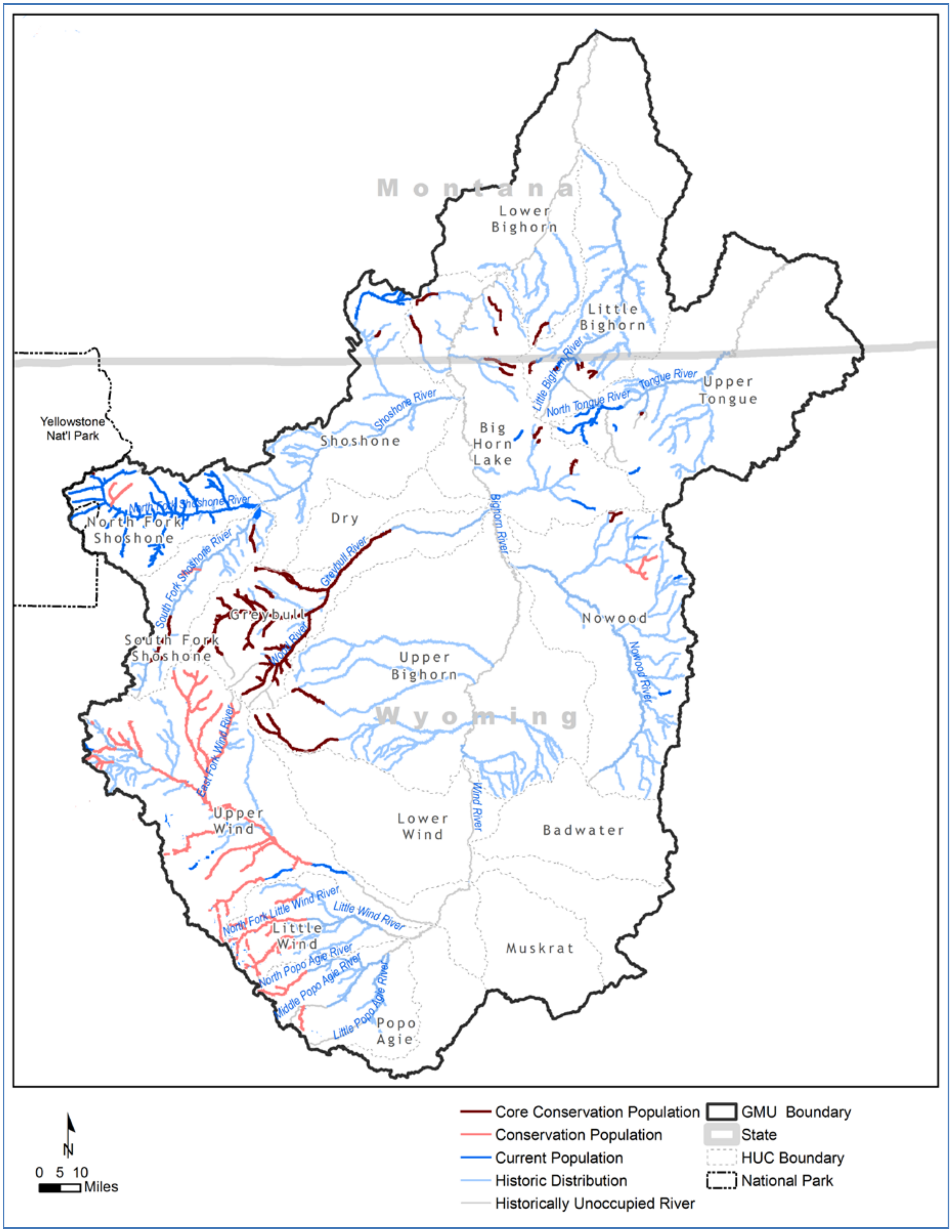

Figure 4-2. Map of the Bighorn Wind GMU.

The 2006 status assessment documented 4,227 stream miles as historically occupied within the Bighorn Wind GMU (Table 4-11). Additions and deletions of stream segments relating to refined interpretation or additional surveys conducted after the 2006 assessment resulted in a net increase of 59 miles. Within the GMU, some streams identified as historically occupied habitat in the 2006 assessment were deleted in 2011, because they probably served only as seasonal migration corridors, and would not have suitable temperature regimes year-round to support Yellowstone cutthroat trout. Most of these adjustments to the historical range were within the Nowood HUC. In addition, the discovery of 35 natural barriers reduced the historical range. In contrast, some barriers thought to be complete barriers to fish movement were found to be partial barriers that allow some upstream passage of Yellowstone cutthroat trout. In any case, at about 1.4%, these changes to historical range were minor, but still provide a more accurate estimate of the historical habitat of Yellowstone cutthroat trout.

Table 4-11. Comparison of the estimated historical distribution of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Bighorn Wind GMU.

Estimates	2006	2011	Change
Miles of historically occupied stream	4,227	4,286	+59
Number of historical populations	193	175	-18

Estimates of population counts and occupied stream miles indicated a decrease of 16 populations in the 2011 assessment, but an increase of 41 miles in occupied stream miles (Table 4-12). The 2011 estimate of 1,143 miles supporting Yellowstone cutthroat trout, excluding recreational populations, is 29% of the historical range of 4,286 miles. Estimates of numbers and stream miles of the populations no longer present changed minimally. Recreational populations changed slightly in the 2011 assessment.

Table 4-12. Comparisons of estimates of current, no longer present, and recreational populations of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Bighorn Wind GMU.

Estimates	2006 Count	2011 Count	Changes in Counts	2006 Miles	2011 Miles	Changes in Miles
Current populations	176	160	-16	1,102	1,143	+41
Populations no longer present	1	0	-1	0.9	0	-0.9
Recreational populations	16	15	-1	98	80	-18
Totals	193	175	-18	1200.9	1,223	+22.1

The alteration in numbers of current populations was the result of various factors. The merging of several populations resulted in a decrease in population number, but not the length of occupied habitat. Discovery of 10 populations, and loss of 2 populations, resulted in minor changes in population counts. Overall, the merging of populations contributed to the 9% reduction in population counts, but reflects the maintenance of gene flow throughout the upper Wind River meta-population. Maintaining or securing connectivity is a high priority in Yellowstone cutthroat trout conservation efforts, so the reduction of population numbers does not equate to a loss of occupied habitat.

Restoration activities, including reclaiming streams for Yellowstone cutthroat trout, were largely accountable for the increase in occupied stream miles, and these efforts offset the minor loss of occupied habitat elsewhere. Yellowstone cutthroat trout reintroductions activities occurred primarily in the South Paintrock Creek basin, Piney Creek, and the Little Tongue River. Correction of a few broken segments in the NHD hydrograph level also account for a small portion of the increase.

With few exceptions, the genetic status of most populations within the Bighorn Wind GMU remained unchanged since the 2006 update (Table 4-13). Genetic testing confirmed the genetic status of a few nonhybridized populations that were previously untested. Merging of populations in the Upper Wind River HUC resulted in an overall reduction in the number of populations with confirmed genetic status. Despite no evidence of invasion, several stream segments were changed from nonhybridized to potentially altered, likely due to discovery of rainbow trout within the greater watershed. Overall, there was a net increase in the number of miles occupied by populations with unaltered genetic status. An ancillary benefit of genetic testing was that it provided information identifying potential sources of nonhybridized Yellowstone cutthroat trout to be used in population replication and brood source development.

Table 4-13. Comparisons of categories of genetic testing and genetic status of Yellowstone cutthroat trout populations in the 2006 and 2011 assessments in the Bighorn Wind GMU.

Genetic Description	2006 Count	2011 Count	Changes in Count	2006 Miles	2011 Miles	Changes in miles
Populations with >1% and ≤10% hybridization	3	3	0	17	16	1
Populations with >10% and ≤25% hybridization	3	3	0	15	15	0
Populations with >25% hybridization	3	3	0	-2	32	0
Populations sympatric with hybridizing species	2	2	0	11	11	0
Populations not tested with suspected hybridization	83	70	3	591	588	-3
Populations not tested, but suspected to be unaltered	53	49	-4	302	295	-7
Unaltered populations (< 1% hybridization)	46	44	-2	233	264	+31
Totals	193	174	-19	1,201	1,221	+20

The number of conservation populations and the miles that they occupy changed slightly between the 2006 and 2011 assessments in the Bighorn Wind GMU (Table 4-14). The number of conservation populations decreased by 2, although one “loss” was the result of a conservation action that removed a human-made barrier on the Greybull River. The other population was lost to a catastrophic flood in Hoodoo Creek. Field surveys documented previously unknown barriers that reduced the miles occupied by Yellowstone cutthroat trout; however, implementation of restoration projects resulted in a net increase of 3 miles of occupied habitat.

Table 4-14. Comparison of number and occupied miles of conservation populations of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Bighorn Wind GMU.

2006 Count	2011 Count	Changes in Counts	2006 Miles	2011 Miles	Changes in Miles
68	66	-2	852	855	+3

Evaluation of changes of population qualifiers indicates minor changes between the 2006 and 2011 assessments (Table 4-15). Identification of new barriers resulted in a net loss of 6 miles of habitat occupied by core populations. Moreover, reestablishment of Yellowstone cutthroat trout in a reclaimed reach of Crooked Creek has lagged, resulting in a loss of occupied miles. There was an increase of 9 miles in the “other” category, with additions from Dinwoody, Piney, Dry Medicine Lodge, and the South Paintrock Creek drainages. Detection of several errors in the “other” category will result in increases in the core category in the next status update.

Table 4-15. Comparison of categories of applicable core population qualifiers of Yellowstone cutthroat trout populations in the 2006 and 2011 assessments for the Bighorn Wind GMU.

Core Population Qualifier	2006 Count	2011 Count	Changes in count	2006 Miles	2011 Miles	Changes in Miles
Core conservation population	32	31	-1	379	373	-6
Known or probable unique life history	1	1	0	14	14	0
Other	34	33	-1	460	469	+9
Totals	67	65	-2	853	856	+3

Changes in the risk of hybridization of current Yellowstone cutthroat trout populations were minimal between the 2006 and 2011 assessments (Table 4-16). Three populations have moved from a known risk of hybridization to an unknown risk; however, the data indicate an increase of 7 miles with no risk of hybridization from 2006 to 2011. Nonetheless, the GMU encompasses many miles of hybrid swarms and reclamation would be infeasible due to the large spatial scale of hybridization.

Table 4-16. Comparison of categories of hybridization risk for Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Bighorn Wind GMU.

Hybrid Risk	2006 Population Count	2011 Population Count	Change in Counts	2006 Miles	2011 Miles	Changes in Miles
Hybridizing species are < 6 miles from population	15	15	0	120	113	-7
Hybridizing species are > 6 miles from population	8	8	0	131	138	+7
Hybridizing species are sympatric	9	8	-1	318	308	-10
No risk of hybridization	35	33	-2	283	290	+7
Unknown risk of hybridization	0	3	+3	0	7	+7
Totals	67	67	0	852	856	+4

Risk of disease changed little during the update period (Table 4-17). No new populations infected with whirling disease have been found within the Bighorn Wind GMU. Nor have reductions in population densities relating to disease been noted. The changes in mileage or number of populations near a source of infection are the result of combining populations and corrections to the NHD.

Table 4-17. Comparison of categories of disease risk from for Yellowstone cutthroat trout populations in the 2006 and 2011 assessments in the Bighorn Wind GMU.

Disease Risk	2006 Count	2011 Count	Changes in Counts	2006 Miles	2011 Miles	Changes in Miles
Limited disease risk	45	43	-2	428	432	+4
Minimal disease risk, > 6 miles from population	22	20	-2	205	200	-5
Moderate disease risk, < 6 miles from population	1	1	0	219	216	-3
Disease risk is unknown	0	2	+2	0	7	+7
Total	68	66	-2	852	855	+3

Connectivity among populations increased during the update period, owing to efforts of fisheries biologists and their conservation partners (Table 4-18). Barrier removal converted weakly networked and isolated populations to moderately networked populations. Considerable effort to improve passage at irrigation diversions has also contributed to increased connectivity among populations, especially in the Upper Wind and Greybull HUCs. These conservation efforts have resulted in a large proportion of Yellowstone cutthroat trout occupied habitat ranking as strongly networked

Table 4-18. Comparison of categories of connectivity of Yellowstone cutthroat trout populations in the 2006 and 2011 assessments in the Bighorn Wind GMU.

Connected	2006 Count	2011 Count	Changes in Counts	2006 Miles	2011 Miles	Changes in Miles
Moderately networked	08	10	+2	156	165	+9
Population isolated	45	42	-3	231	232	+1
Strongly networked	4	4	0	361	358	-3
Weakly networked	11	10	-1	104	100	-4
Total	68	66	-2	852	855	+3

4.3 Upper Snake GMU

The Upper Snake GMU is the smallest of the GMUs, and falls across portions of Wyoming and Idaho (Figure 4-3). The Snake River is the largest river in the HUC. It originates in Wyoming, including parts of YNP, and extends to its confluence with Henrys Fork in Idaho. The Upper Snake GMU encompasses a portion of 2nd level HUC 1704, and contains 5 4th level HUCs.

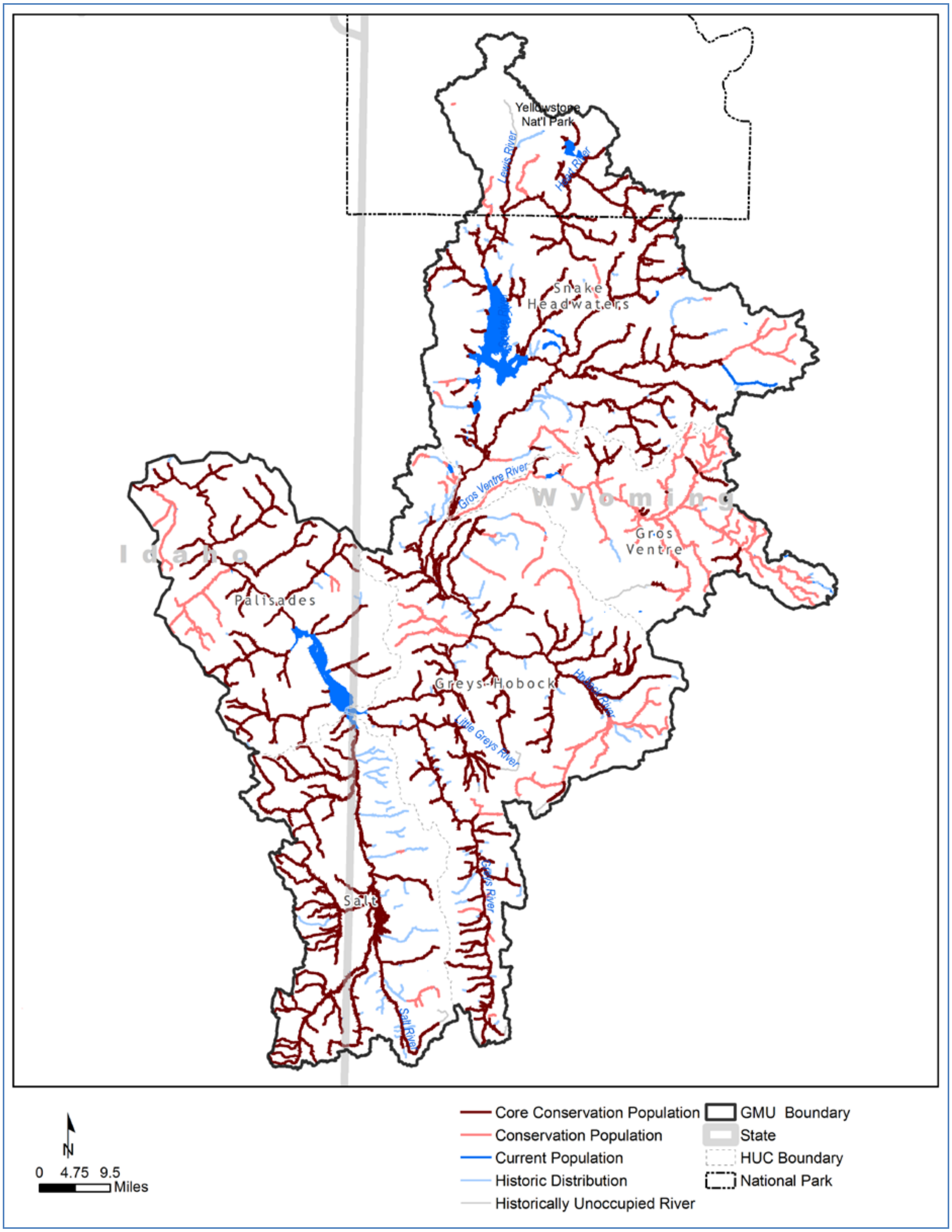

Figure 4-3: Upper Snake GMU.

Updates to the database did not alter the extent of the historical distribution; however, currently occupied stream miles decreased by 61 in the 2011 assessment (Table 4-19). The decrease in currently occupied stream miles indicates Yellowstone cutthroat trout are no longer present in 253 miles, which is 9% of the historical habitat. This loss equates to a decrease of 43 miles from the 2006 estimate, in which 6% of the historically occupied habitat no longer supported Yellowstone cutthroat trout. Compared to the 43% reduction from the historically occupied habitat range-wide, the Upper Snake GMU has the most intact distribution of Yellowstone cutthroat trout among GMUs. These minor changes do not reflect reductions in Yellowstone cutthroat trout populations or their occupied habitat. The alterations are the result of ground surveys verifying presence or absence of Yellowstone cutthroat trout and corrections to the database. No data were available for the number of populations for either the 2006 or 2011 assessments, so drawing inference on potential changes of this parameter is not possible.

Table 4-19. Comparisons of estimated historical population counts and stream miles occupied by Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Upper Snake GMU.

Population	2006 Count	2011 Count	2006 Miles	2011 Miles	Change in Miles
Historical	-	-	2,755	2,755	0
Current	304	303	2,563	2,502	-60
Total change	N/A	N/A	-192	-253	-43

Examination of conservation populations and populations no longer present indicate a small proportion of the known populations have been extirpated since the 2006 assessment (Table 4-20). Moreover, the absence of recreational populations reflects a lack of hybridization within the GMU. Minor changes in population counts and stream miles are the result of corrections to the database, and ground surveys that verified the presence or absence of populations.

Table 4-20. Comparisons of estimates of counts and miles of current, no longer present, and recreational populations of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Upper Snake GMU

Population Type	2006 Count	2011 Count	2006 Miles	2011 Miles	Change in Miles
Current populations	304	300	2,550	2,495	-55
Populations no longer present	7	3	12	7	-5
Recreational populations	0	0			
Total	311	303	2,562	2,502	-60

Genetic status of population counts and miles of occupied habitat changed in positive and negative directions during the data review (Table 4-21). The number of hybridized populations and their corresponding miles of stream changed little between assessments, and represent a relatively small proportion of Yellowstone cutthroat trout populations. Other changes reflect field efforts between assessments to determine genetic status of populations, resulting in a decrease of untested populations. As in the 2006 assessment, the vast majority of populations ranked as nonhybridized, with 226 known populations occupying over 1,800 miles of habitat. The extensive presence of nonhybridized Yellowstone cutthroat trout makes the Upper Snake GMU a vital stronghold for the species.

Table 4-21. Comparisons of categories of genetic testing and genetic status of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Upper Snake River GMU.

Genetic Description	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Populations with >1% and ≤10% hybridization	7	6	-1	93	93	0
Populations with >10% and ≤25% hybridization	1	1	+0	13	13	0
Populations with >25% hybridization	1	0	-1	2	0	-2
Populations sympatric with hybridizing species	5	5	+0	34	34	0
Not applicable	6	3	-3	11	7	-4
Populations not tested with suspected hybridization	9	9	+0	118	113	-5
Populations not tested, but suspected to be unaltered	59	53	-6	480	388	-92
Unaltered populations (< 1% hybridization)	223	226	+3	1,811	1,856	+45
Total	311	303	-8	2,562	2,502	60

Conservation populations declined in terms of number of populations and number of occupied miles between assessments (Table 4-22); however, corrections of database inaccuracy accounts for most of the change. The number of conservation populations decreased by 10 between the 2006 and 2011 assessments. The primary cause of the decline was omission of Rock Creek, Glade Creek, Turpin, Owl and Soda Fork creeks in the 2011 database. Incorrect designation of streams as supporting Yellowstone cutthroat trout were corrected for the 2011 assessment. The only expansion of Yellowstone cutthroat trout was into Indian Creek. As with several other parameters, corrections of data in the database will provide a more robust accounting of Yellowstone cutthroat trout in the next assessment.

Table 4-22. Comparison of population counts and occupied miles of conservation populations of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Upper Snake GMU.

2006 Count	2011 Count	2006 Miles	2011 Miles
103	93	2,563	2,492

When conservation populations were subcategorized (core conservation population, known or probable unique life history, or other), minor reductions in counts were seen in two of the three categories (Table 4-23). Small decreases in mileage occurred in all categories. Notably, the known or probable unique life history category was reduced in number and mileage due to a change in the status of an extensive tributary to the South Buffalo Fork. Changes in the “other” category can be attributed to Ditch Creek and one tributary that feeds the South Buffalo Fork. These appear to be data entry errors that require rectification.

Table 4-23. Comparisons of categories of population conservation type of Yellowstone cutthroat trout between the 2006 and 2011 assessments in the Upper Snake GMU.

Conservation Type	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Core conservation population	44	44	0	1,946	1,917	-29
Known or probable unique life history	18	12	-6	339	320	-19
Other	38	34	-4	220	196	-24
Total	100	90	-10	2,505	2,433	-72

Changes in population counts or miles with risk of hybridization were minor (Table 4-24). The number of populations rated as having no risk decreased by 8 between the 2006 and 2011 assessments. However, this alteration in status is likely a data entry error associated with a tributary of the South Fork Buffalo River. Another major database error is misclassification of the South Fork Snake drainage as lacking hybridizing species when nonnative species are sympatric.

Table 4-24. Comparisons of categories of genetic testing and genetic status between the 2006 and 2011 assessments in the Upper Snake GMU.

Hybridization Risk	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Hybridizing species are < 6 miles from population	14	14	0	262	239	-23
Hybridizing species are > 6 miles from population	34	34	0	719	706	-13
Hybridizing species are sympatric	7	6	-1	745	744	-1
No risk of hybridization	47	39	-8	838	803	-35
Total	102	93	-9	2,564	2,492	-72

Disease risk counts were similar between the 2006 and 2011 assessments (Table 4-25).The biggest change noted was a decrease of 10 in the number of populations considered at limited risk, which resulted in a decrease of 54 miles for the same category. These changes are tied to the data entry issues identified above.

Table 4-25. Comparison of categories of disease risk from for Yellowstone cutthroat trout populations in the 2006 and 2011 assessments in the Upper Snake GMU.

Disease Risk	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Limited risk	87	77	-10	1,469	1,415	-54
Minimal disease risk, > 6 miles from population	11	11	0	438	419	-19
Moderate disease risk, < 6 miles from population	3	3	0	353	353	0
Population is infected	2	2	0	306	304	2
Total	103	93	-10	2,566	2,491	-75

Categories of connectivity changed relatively little between the 2006 and 2011 assessments (Table 4-26). The number of moderately networked populations remained the same, although the number of miles decreased by 13 due to corrections to the database or field investigations. Isolated populations declined by 10. Three segments of Pacific Creek and inclusion of Indian Creek accounted for much of this change. Corrections of database classifications for Glade Creek, Rock Creek, Owl Creek, Arizona Creek, and one tributary to the South Buffalo Fork resulted in a reduction of strongly networked streams by 38 miles.

Table 4-26. Yellowstone cutthroat trout connectivity count and miles by year in the 2006 and 2011 assessments in the Upper Snake GMU.

Connection	2006 Count	2011 Count	Change in Count	2006 miles	2011 miles	Change in miles
Moderately networked	4	4	0	149	136	-13
Population isolated	73	63	-10	249	250	+1
Strongly networked	20	18	-2	1,948	1,910	38
Weakly networked	9	8	-1	218	196	22
Total	106	93	-13	2,564	2,492	72

4.4 Lower Snake GMU

The lower Snake GMU spans all states in the historical range of the Yellowstone cutthroat trout with the exception of Montana. The bulk of this GMU is in Idaho: however its headwaters originate in western Wyoming and YNP. The Lower Snake GMU is in the same 2nd level HUC as the Upper Snake GMU (1704), and contains 13 4th level HUCs.

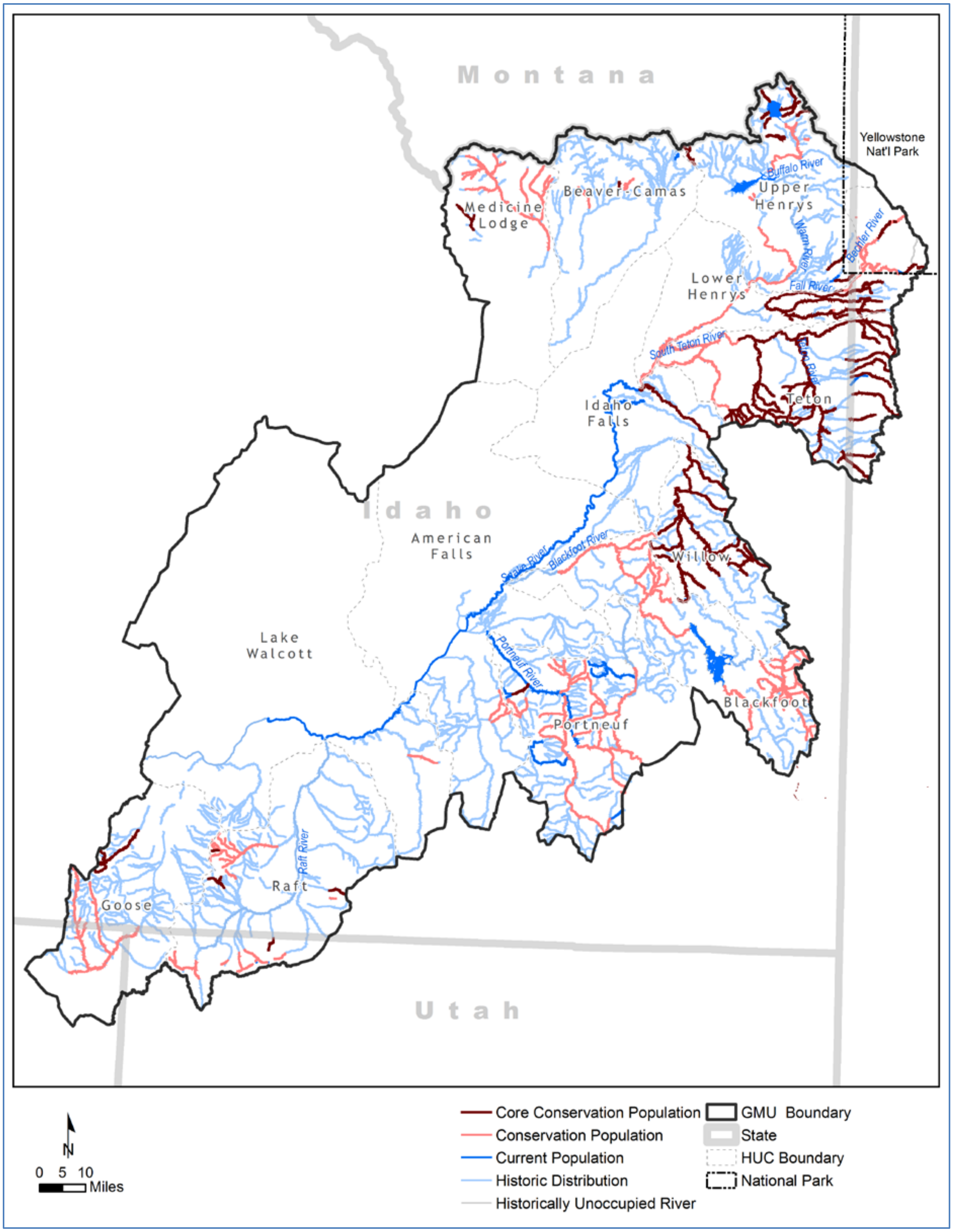

Figure 4-4. Map of the Lower Snake GMU.

Several alterations in historically occupied miles and numbers of populations occurred between the 2006 and 2011 assessments (Table 4-27). The number of miles that were considered to be historically occupied by Yellowstone cutthroat increased slightly from 6,280 in the 2006 assessment to 6,284 in the 2011 assessment (Table 4-27). These small increases were often the result of discovery of a fish barrier or refinement of the NHD dataset. According to the revised data, Yellowstone cutthroat trout occupy 34% of their historical habitat in the Lower Snake GMU.

Table 4-27. Comparison of the estimated historical distribution of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Lower Snake GMU.

Population	2006 Count	2011 Count	2006 Miles	2011 Miles
Historic	-	-	6,280	6.284
Current	260	265	1,971	2,129

Between the 2006 and 2011 assessments, the current distribution of Yellowstone cutthroat trout increased by 5 populations and 158 miles, due to identification of additional populations through field surveys. These additions include Marsh Creek and the Portneuf River, and portions of the Henrys Fork. Renovation projects like the ones on north and south Sawtell creeks and Corral Creek also contributed to the increase in current fish distribution.

The number of existing populations increased by 11 during the update period (Table 4-28), which is a result of the addition of streams not included in the 2006 assessment. These streams include Marsh Creek, the Portneuf River, and portions of the Henrys Fork. Moreover, reclamation projects in several streams, including North and South Sawtell creeks and Corral Creek have also contributed to increases in numbers of populations and increases in occupied stream miles.

Table 4-28. Comparisons of estimates of current, no longer present, and recreational populations of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Lower Snake GMU.

Population Type	2006 Count	2011 Count	2006 Miles	2011 Miles	Change in Miles
Current	224	235	1,710	1,773	+63
No Longer Present	32	26	158	131	-27
Recreation	4	4	103	224	+121
Conservation	84	92	1,709	1,843	+134
Total	260	265	1,971	2,128	+157

The number of populations listed as no longer present also increased between assessments (Table 4-28). This apparent “loss” of populations may be related to the erroneous reclassification of several reservoirs as no longer supporting Yellowstone cutthroat trout. These reservoirs include

Blackfoot Reservoir, Island Park, and Henrys Lake. These errors will be corrected before the next status update.

Although the number of recreation populations remained the same, the number of miles occupied by recreation populations increased by 121 miles (Table 4-28). The alteration does not reflect a change in the number of miles of occupied habitat, but reflects data that were excluded in the 2006 assessment. Many remaining changes are the result of on-the-ground survey and inventory that have verified the actual extent of a number of populations. Further changes were the result of scrutiny and rectification of incorrect data in the database.

The number of conservation populations and the number of miles occupied by conservation populations increased between the 2006 and 2011 assessments (Table 4-28), partially a result of the addition of river segments and populations in the Portneuf and Henrys Fork drainages. Field investigations confirmed the presence of an additional 134 miles occupied by conservation populations.

Categories of populations increased in the number and mileage of core conservation populations between assessments (Table 4-29). This change is the result of population renovations and reclassification of data errors from 2006. Known or probable unique life history category decreased because the Fall River drainage was reclassified to core conservation population, which was most likely the result of a data entry error. The “other” category also had a large increase in occupied miles. Justification for this marked change will be examined before the next status update.

Table 4-29. Comparison of categories of applicable core population qualifiers of Yellowstone cutthroat trout populations in the 2006 and 2011 assessments in the Lower Snake GMU.

Conservation Type	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Core conservation population	22	37	+15	736	776	+40
Known or probable unique life history	54	44	-10	646	494	-152
Other	5	9	+4	24	299	+275
Total	81	90	+9	1,406	1,569	+163

Numerous minor changes in genetic status occurred between the 2006 and 2011 assessments (Table 4-30). Many of these changes are the result of increased scrutiny of the data used in the 2006 summaries, but others are the result of newly processed genetic samples from a number of populations within the GMU. In addition, several renovation and restoration projects increased the number of nonhybridized populations and occupied stream miles. Of note, the increase in “not tested – suspected hybridized” is the result of including new stream reaches to the database, and does not reflect changes in genetic status of any populations. Similarly, the reduction in the "unaltered" category shows a reduction in the miles occupied by genetically unaltered fish, mainly because genetic testing showed hybridization among the trout in Trout Creek, which had been assumed to be nonhybridized. New genetic analysis resulted in the reclassification of Goose Creek from suspected nonhybridized to hybridized.

Table 4-30. Comparisons of categories of genetic testing and genetic status of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Lower Snake GMU.

Genetic Description	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Populations with >1% and ≤10% hybridization	20	22	+2	244	245	+1
Populations with >25% hybridization	3	3	0	51	51	0
Populations sympatric with hybridizing species	1	4	+3	1	26	+25
Not applicable	0	2	+2	0	19	+19
Populations not tested with suspected hybridization	26	21	-5	106	79	-27
Populations not tested, but suspected to be unaltered	90	90	0	797	1,011	+214
Unaltered populations (< 1% hybridization)	95	91	-4	553	519	-34
Populations with >25% hybridization	25	32	+7	18	180	-38
Total	260	265	+5	1,971	2,130	+159

Hybridization risk changed in most categories between the 2006 and 2011 assessments (Table 4-31). The changes are typically the result of surveys, population renovations, and errors in data entry. To correct possible data entry errors and to verify hybridization risk, these data will be proofread before the next status update.

Table 4-31. Comparisons of categories of risk of hybridization in the 2006 and 2011 assessments in the Lower Snake GMU.

Hybridization Risk	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Hybridizing species are < 6 miles from population	42	36	6	553	420	-133
Hybridizing species are > 6 miles from population	13	14	+1	503	593	+90
Hybridizing species are sympatric	9	9	0	506	551	+45
No risk of hybridization	20	25	+5	148	169	+21
Unknown risk of hybridization	0	06	+6	0	112	+112
Total	84	90	+6	1,710	1,845	+135

In the Lower Snake GMU, the risk of disease for specific stream miles changed across the 3 degrees of risk (Table 4-32). Disease risk for the infected populations and the unknown categories changed markedly. These changes were the result of addition of new data and do not reflect an increase in infected populations. Likewise, the increase in the "unknown" category is the result of additions of new data and does not indicate any changes in the risk of disease risk.

Table 4-32. Comparison of categories of disease risk from for Yellowstone cutthroat trout populations in the 2006 and 2011 assessments in the Lower Snake GMU.

Disease Risk	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Limited risk	38	41	+3	580	572	-8
Minimal disease risk, > 6 miles from population	27	23	-4	221	201	-20
Moderate disease risk, < 6 miles from population	17	17	0	571	567	-4
Population is infected	2	4	+2	338	393	+55
Risk is unknown	0	6	+6	0	111	+111
Total	84	91	+7	1,710	1,844	+134

Substantial changes in connectivity of habitat for Yellowstone cutthroat trout occurred in some categories (Table 4-33); however, the most significant changes were the result of adding new data to the database. The apparently marked improvement in strongly networked stream miles, and the seemingly large loss of moderately networked streams, was an artifact of additional data, not changes on the landscape. The miles of isolated habitat did decrease by 7 miles. Weakly connected streams increased in number and miles. The extent to which these results reflect changes in connectivity or the addition of data is unknown.

Table 4-33. Comparisons of connectivity in the 2006 and 2011 assessments in the Lower Snake GMU.

Connection	2006 Count	2011 Count	Change in Count	2006 miles	2011 miles	Change in miles
Moderately networked	12	13	+1	877	796	-81
Population isolated	39	36	-3	111	104	-7
Strongly networked	8	13	+5	490	703	+213
Weakly networked	25	28	+3	231	244	+13
Total	84	90	+6	1,709	1,847	+138

4.5 Yellowstone GMU

The Yellowstone GMU (Figure 4-5) originates in Wyoming and encompasses about half of YNP. The majority of the GMU lies in Montana, although a substantial portion is in northern Wyoming. Yellowstone Lake is a notable lentic feature in this GMU. The Yellowstone GMU is within the 1007 2nd-level HUC, and contains 8 4th-level HUCs.

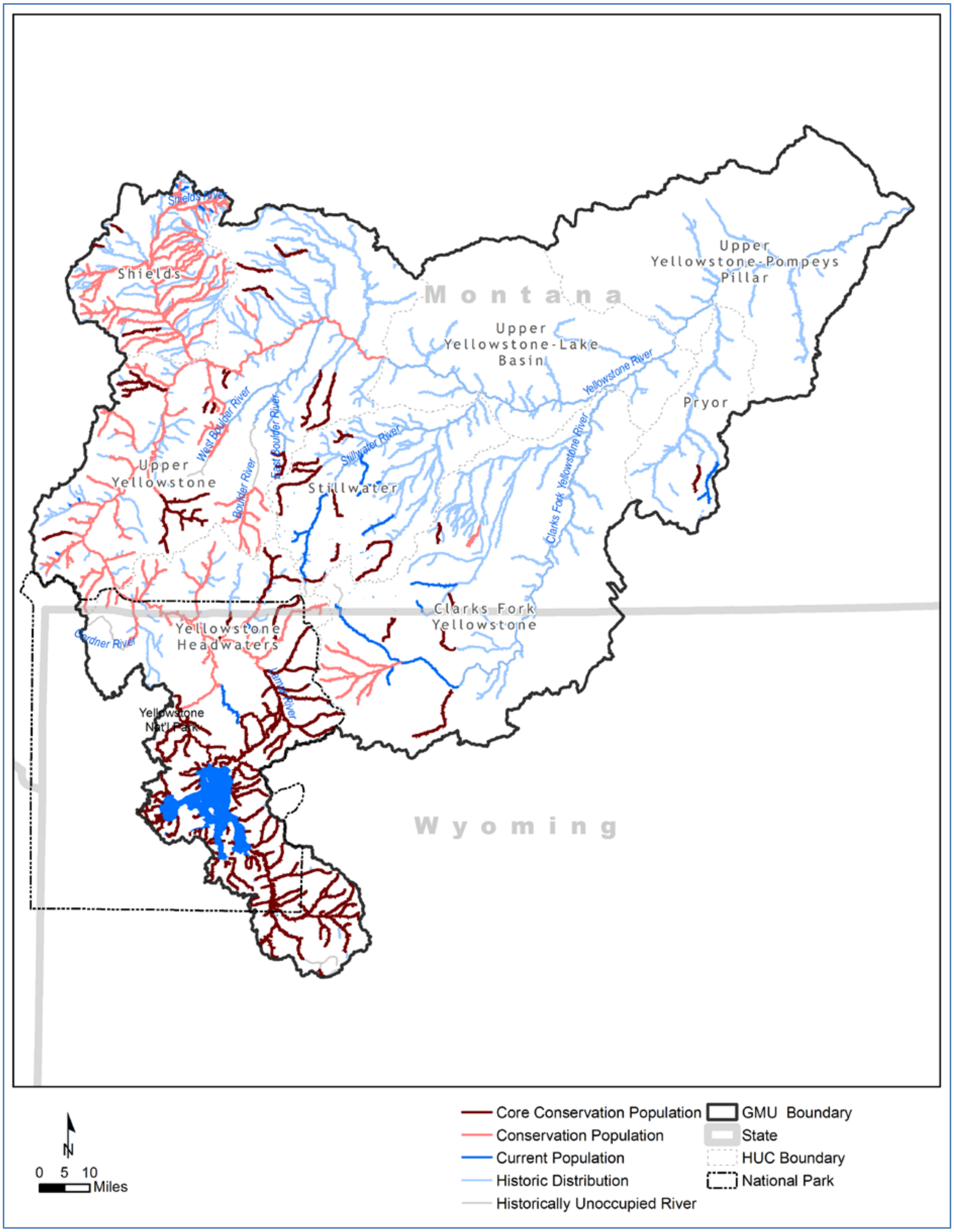

Figure 4-5. Map of the Yellowstone GMU.

Minor changes in the current and historical range and numbers of Yellowstone cutthroat trout populations between assessments reflect refinement of the estimates (Table 4-34). No counts of historical populations are available, but the number of current populations remained the same during the update period. The number of miles that are presumed to have supported historical populations of Yellowstone cutthroat trout increased by 4 miles and the number of currently occupied miles increased by 7 miles.

Table 4-34. Comparison of the estimated historical distribution of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the in the Yellowstone GMU.

Population	2006 Count	2011 Count	2006 Miles	2011 Miles
Historical	-	-	4,477	4,481
Current	320	320	2,189	2,196

Populations classified as current, no longer present, or recreation, changed little between the 2006 and 2011 assessments (Table 4-35). A net increase of 7 miles of occupied habitat was the result of gains of 9 miles that were known to support Yellowstone cutthroat trout, offset by a decrease in 2 miles of habitat where Yellowstone cutthroat trout were no longer present. These changes in estimates of inhabited miles are the result of field surveys that verified the extent of Yellowstone cutthroat trout distribution in some streams, and do not indicate losses or gains in occupied miles.

Table 4-35. Comparisons of estimates of current, no longer present, and recreational populations of Yellowstone cutthroat trout in the 2006 and 2011 assessments in the Yellowstone GMU.

Population Type	2006 Count	2011 Count	2006 Miles	2011 Miles	Change in Miles
Current	316	316	2,171	2,180	+9
No longer present	4	4	18	16	-2
Recreational	0	0	0	0	+0
Total	320	320	2,189	2,196	+7

Analyses of genetic samples collected from throughout the GMU led to several changes in reported genetic status (Table 4-36). A previously untested population was classified as a conservation population, and this testing increased the number of conservation populations by 1, and added 12 miles of habitat. Although the number of populations with more than 10%, but less than 25% hybridization, remained at 4, field surveys resulted in a decrease of habitat supporting these populations by 5 miles. Highly hybridized fish, or those with more than 25% hybridization, increased by 1 population and 4 miles of habitat. The number of untested populations presumed to be hybridized increased by 3, resulting in a 21-mile increase in stream miles with uncertain genetic status. Conversely, genetic testing decreased the number of populations thought to be unaltered by 4 populations and increased the number of stream miles of known genetic status by

34 miles. The number of known unaltered populations increased by 1, and this change corresponded with an increase in 4 miles of habitat occupied by unaltered Yellowstone cutthroat trout. Overall, known unaltered populations of Yellowstone cutthroat trout represent the largest number of stream miles among all categories and encompass about 40% of stream habitat supporting Yellowstone cutthroat trout in this GMU.

Table 4-36. Comparisons of genetic testing status and genetic status in the 2006 and 2011 assessments in the Yellowstone GMU.

Genetic Description	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Populations with >1% and ≤10% hybridization	32	33	+1	258	270	+12
Populations with >10% and ≤25% hybridization	4	4	+0	25	20	-5
Populations with >25% hybridization	3	4	+1	20	24	+4
Populations in sympatry with hybridizing species	6	6	+0	124	130	+6
Not applicable	4	2	-2	18	14	+-4
Populations not tested with suspected hybridization	53	56	+3	356	377	+21
Populations not tested, but suspected to be unaltered	114	110	-4	536	502	-34
Unaltered populations (< 1% hybridization)	104	105	+1	853	857	+4
Total	320	320	+0	2,190	2,194	+4

Field investigations during the update period identified 4 new conservation populations and a decrease in 41 miles of occupied habitat (Table 4-37). As these changes are an artifact of increased field survey, they should not be interpreted as gains in population numbers or losses in distribution of Yellowstone cutthroat trout.

Table 4-37. Comparisons of Yellowstone cutthroat trout conservation populations and occupied stream miles in the 2006 and 2011 assessments in the Yellowstone GMU.

2006 Count	2011 Count	2006 Miles	2011 Miles
53	57	2,085	2,044

Different categories of conservation populations changed due to field surveys occurring during the update period (Table 4-38). Despite an increase of 3 core conservation populations, the extent of habitat occupied by this category decreased by 32 miles because field surveys confirmed the actual distribution. Similarly, the extent of stream habitat supporting Yellowstone cutthroat trout with a known or probable unique life history decreased by 74 miles. This change was also related to field surveys refining our knowledge of fish distribution. The "other" category of conservation population grew by 1, which corresponded with a 64-mile increase of stream miles with potential for a focus on conservation..

Table 4-38. Comparisons of current populations in the 2006 and 2011 assessments in the Yellowstone GMU.

Conservation Type	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Core conservation population	41	44	+3	1,013	981	-32
Known or probable unique life history	8	8	0	971	897	-74
Other	4	5	+1	101	165	+64
Total	53	57	+4	2,085	2,043	+42

Estimates of risk of hybridization changed for all categories during the review (Table 4-39). Some of these changes were changes related to the additional data gathered through field surveys; however, other changes were real changes due to conservation actions. The number of populations < 6 miles from hybridizing species decreased by 3, leading to a 62-mile decrease in stream miles for this category. In contrast, for populations that were > than 6 miles from hybridizing species, there was no difference in the number, although a 5 additional miles of occupied habitat were documented to be > 6 miles from hybridization risk.

Table 4-39. Comparison of hybridization risk in the 2006 and 2011 assessments in the Yellowstone GMU.

Hybridization Risk	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Hybridizing species are < 6 miles from population	19	22	+3	1,221	1,159	-62
Hybridizing species are > 6 miles from population	7	7	+0	29	34	+5
Hybridizing species are sympatric	5	5	+0	608	574	-34
No risk of hybridization	22	21	-1	227	202	-25
Unknown risk of hybridization	0	2	+2	0	74	+74
Total	53	57	+4	2,085	2,043	-42

Changes in disease risk occurred in 3 categories in 2011 (Table 4-40). An additional 2 populations rated as having limited risk, which corresponded with an increase of 55 miles of stream in this category. Populations with minimal risk of disease increased by 1; however, field surveys, corrections to the database, or both decreased the miles of populations at minimal risk by 35 miles. "Populations with an unknown risk" was the only other category that changed with addition of 1 population occupying 7 miles of stream.

Table 4-40. Comparison of disease risk in the 2006 and 2011 assessments in the Yellowstone GMU.

Disease Risk	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Limited risk	25	27	+2	277	332	+55
Minimal disease risk, > 6 miles from population	15	16	+1	583	548	-35
Moderate disease risk, < 6 miles from population	7	7	0	90	90	0
Population is infected	3	3	0	490	452	-38
Significant disease risk (sympatric)	3	3	0	644	615	-29
Risk is unknown	0	1	+1	0	7	+7
Total	53	57	+4	2,084	2,044	-40

Connectivity varied little for most populations of Yellowstone cutthroat between assessments, although some categories showed dramatic change (Table 4-41). Counts of moderately networked streams remained at 10, and the miles decreased by only 1 mile. The number of isolated populations increased by 4, and was the only category that had an increase in occupied miles. These changes were the result of newly identified conservation populations and barrier construction. Decreases in mileage occurred in the 3 remaining categories. The largest decrease was a loss of 91 miles in the strongly networked category, although number of populations remained the same. The cause of this change may be the result of correcting data or category errors.

Table 4-41. Comparison of connectivity in the 2006 and 2011 assessments in the Yellowstone GMU

Connectivity	2006 Count	2011 Count	Change in Count	2006 Miles	2011 Miles	Change in Miles
Moderately networked	10	10	0	165	164	-1
Population isolated	31	35	+4	222	275	+53
Strongly networked	9	9	0	1,659	1,568	-91
Weakly networked	3	3	+0	039	37	-2
Total	53	57	+4	2,085	2,044	-41

5.0 Conservation Actions Implemented Since 2000

From 2000 through 2011, agencies, nonprofits and landowners completed nearly 90 conservation projects. The types of conservation projects were highly variable (Table 5-1), and addressed a range of actions aimed at securing Yellowstone cutthroat trout populations. In general, these projects improved habitat, increased water quantity, restored populations and provided barriers to invasion of nonnative fishes. Conversely, some projects removed barriers to improve connectivity, provide more habitat, increase gene flow and improve connectivity. Projects occurred throughout the historical range of Yellowstone cutthroat trout (Figure 5-1), and included projects that addressed large, connected portions of the range, and some isolated watersheds and streams. Partners in implementing conservation projects included Montana Fish, Wildlife & Parks, Wyoming Game and Fish Department, the National Park Service, the U.S. Forest Service, the Bureau of Land Management, Idaho Fish and Game, and the U.S. Fish and Wildlife Service. Nonprofit groups including Trout Unlimited and many of its chapters, and the Montana Trout Foundation were collaborators on many projects. Private landowners deserve special acknowledgment for their collaboration, and permission to access private lands

Table 5-1. Types of conservation projects implemented

Action ID	Description of Conservation Action
1	Water lease/In-stream flow enhancement
2	Channel restoration
3	Bank stabilization
4	Riparian restoration
5	Diversion modification
6	Barrier removal
7	Barrier construction
8	Culvert replacement
9	Installation of fish screens to prevent loss
10	Fish ladders to provide access
11	Spawning habitat enhancement
12	Woody debris placement
13	Pool development
14	Increase irrigation efficiency
15	Grade control
16	In-stream cover habitat
17	Re-founding pure population
18	Riparian fencing
19	Physical removal of competing/hybridizing species
20	Chemical removal of competing/hybridizing species
21	Public outreach efforts at site (Interpretative site)
22	Population Restoration/Expansion
23	Population supplementation (e.g. to implement genetic swamping or to reduce potential of bottle necking, etc.)
24	Special Angling Regulations
25	Land-use mitigation direction and requirements (e.g. Forest Plan direction, regulation, permit req., coordination stipulations, etc)
26	Population covered by special protective mgt emphasis (e.g. Nat'l Park, wilderness, special mgt area, conservation easement, etc.)
27	Other (List in comments)
28	None

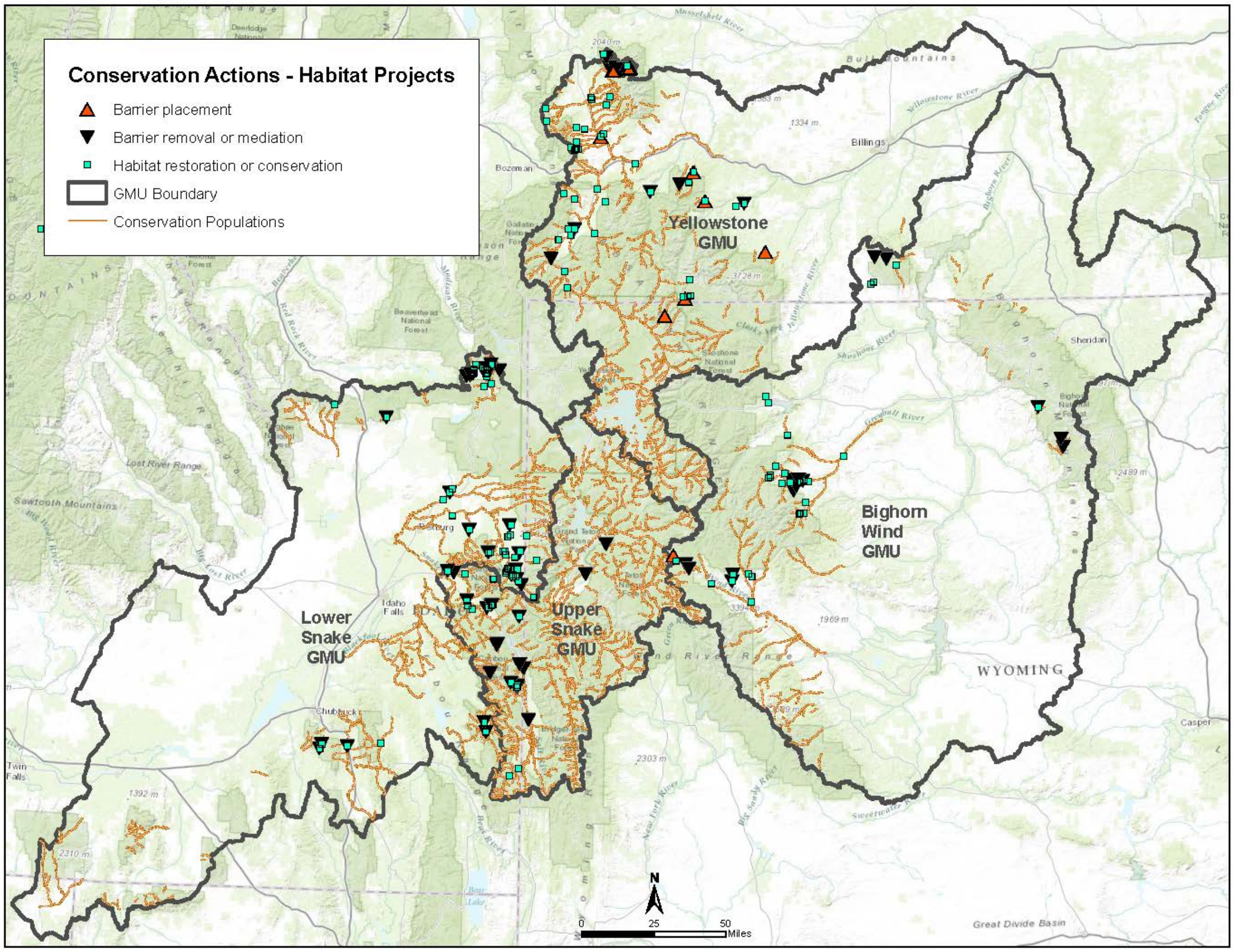

Figure 5-1. Distribution and types of projects aimed at conserving Yellowstone cutthroat trout in its historical range.

From 2000 through 2011, conservation projects have occurred in all the GMUs. The following tables provide an accounting of the various projects and the specific conservation actions occurring for each project, broken down by GMU

Table 5-2. Conservation projects and the specific actions that occurred within the Bighorn Wind GMU from 2000 through 2011. Code numbers correspond to specific conservation actions described in Table 5-1.

State	Code	Project
Montana	22	Big Bull Elk Creek YCT Expansion
Montana	22	Big Bull Elk Creek YCT Expansion
Montana	22	Black Canyon Creek YCT Expansion
Montana	22	Black Canyon Creek YCT Expansion
Montana	8	Culvert Replacement
Montana	22	East Basin Creek YCT Expansion
Montana	22	Little Bull Elk Creek YCT Expansion
Montana	5,9,12,13,18	Piney Creek Habitat Restroration and pool development
Montana	12,13	Piney Creek Winter Habitat
Montana	18	Riparian Fencing
Montana	17,19,22	Sage Creek YCT Restoration
Montana	22	Summit Creek YCT Expansion
Wyoming	22	Anderson Creek expansion
Wyoming	4	Conifer removal
Wyoming	22	Cow Creek expansion
Wyoming	6	Culvert removal
Wyoming	8	Culvert replacement
Wyoming	6,8	Culvert replacement
Wyoming	4,8,18	Culvert replacement, Riparian fencing and vegetation restoration
Wyoming	1	Dick Creek Instream Flow filing
Wyoming	5, 6, 9, 14	Diversion consolidation and screening
Wyoming	5,6	EA Ranch diversion modification
Wyoming	3	East Fork bank stabilization
Wyoming	22	Eleanor expansion
Wyoming	20	Elkhorn Creek YCT Conservation
Wyoming	20	Elkhorn Creek YCT Conservation
Wyoming	20	Elkhorn Creek YCT Conservation
Wyoming	27	Elkhorn Creek YCT Conservation
Wyoming	5,9	Fosher Ditch diversion and fish screen
Wyoming	6, 8	Francs Fork culvert replacement
Wyoming	1	Francs Fork Instream Flow filing
Wyoming	22	Greybull River expansion
Wyoming	1	Greybull River Instream Flow filing
Wyoming	7	Highway 287/26 crossing
Wyoming	5,9	Holmes Diversion
Wyoming	14, 18	Irrigation infiltration gallery
Wyoming	1	Jack Creek Instream Flow filing
Wyoming	20	Little Tongue Treatment
Wyoming	20	Little Tongue Treatment
Wyoming	22	Little Tongue Treatment
Wyoming	1	Marquette Creek Instream Flow filing
Wyoming	1	Middle Fork Wood River Instream Flow filing

Table 5-2 continued

Wyoming	6, 8	Middle West Timber Creek -- State Land Project
Wyoming	4, 18	Newell Spring Creek CCRP, Riparian restoration
Wyoming	22	North Cow Creek expansion
Wyoming	1	North Fork Pickett Creek Instream Flow filing
Wyoming	11	Pelham Lake spawning habitat
Wyoming	1	Pickett Creek Instream Flow filing
Wyoming	1	Piney creek Instream Flow filing
Wyoming	20	Red Gulch YCT Conservation
Wyoming	27	Red Gulch YCT Conservation
Wyoming	20	Remove competing species
Wyoming	22	Remove competing species
Wyoming	4, 18	Riparian Fencing and riparian vegetation restoration
Wyoming	18	Riparin Fencing (Shepperson Ranch)
Wyoming	1	South Fork Wood River Instream Flow filing
Wyoming	19	South Little Tongue YCT Conservation
Wyoming	5,6	State land diversion modification
Wyoming	22	TE Spring Creek expansion
Wyoming	6, 8	Timber Creek -- Greybull River Road culvert replacement
Wyoming	22	Transplant
Wyoming	22	Transplant
Wyoming	9	Trout Creek diversion screening
Wyoming	22	Trout Creek expansion
Wyoming	1	Trout Creek Instream Flow filing
Wyoming	10	Upper Sunshine Diversion Fish Ladder
Wyoming	6, 8	Upper West Timber Creek -- Ford project
Wyoming	20	West Pass Creek YCT Conservation
Wyoming	1	West Timber Creek Instream Flow filing
Wyoming	22	Winant's Spring creek expansion
Wyoming	1	Wood River Instream Flow filing

Table 5-3. Conservation projects and the specific actions that occurred within the Upper Snake GMU from 2000 through 2011. Code numbers correspond to specific conservation actions described in Table 5-1.

State	Code	Project
Idaho	8	Anderson Creek Aquatic Passage
Idaho	19	Burns Creek genetic restoration
Idaho	2	Burns Creek Restoration
Idaho	6	Caboose Culvert
Idaho	1,5,6,9	Celeste Beam Diversion
Idaho	2,4,5,9	Conant Valley Ranch
Idaho	2,4	Crow Creek Restoration
Idaho	6	Culvert
Idaho	2,4,8,18	Deep Creek Stream Restoration
Idaho	8	Elk Creek Passage
Idaho	4	Fall Ck Dispersed Camping Management
Idaho	6	FS 087 Culvert
Idaho	6	FS 206 culvert
Idaho	1,2,3,4,8,14,18	Garden Creek Restoration
Idaho	1,5,6,9	Glen Bills
Idaho	4,8	Jackknife Ck Comprehensive Watershed Improvement
Idaho	2	McGrath Restoration
Idaho	19	Palisades Creek genetic restoration
Idaho	2,6	Passage
Idaho	2,3,4,16	Phase 1
Idaho	2,3,4,16	Phase 2
Idaho	2,3,4,5,18	Pritchard Ck Watershed Restoration
Idaho	4,3	Rainey Creek Restoration
Idaho	3	Red Creek Streambank Stabilization
Idaho	2,6	Restoration
Idaho	27	Riparian protection
Idaho	1,5,6,9	Shurtleff
Idaho	7	South Fork Snake River tributary weir
Idaho	19	South Fork Snake River tributary weir
Idaho	2,8,15	Table Rock Fish Passage
Idaho	8	Trout Creek Passage
Idaho	8	Wolverine Creek Passage
Wyoming	8	Burns Creek Passage
Wyoming	20	Dry Creek Lake chemical removal
Wyoming	6	FS 087 Culvert
Wyoming	19	Gros Ventre River rainbow trout removal
Wyoming	6	Newbold Dam removal
Wyoming	10	Salt River fish passage
Wyoming	6	Spread Creek diversion removal
Wyoming	20	Stump Lake chemical removal

Table 5-4. Conservation projects and the specific actions that occurred within the Lower Snake GMU from 2000 through 2011. Code numbers correspond to specific conservation actions described in Table 5-1.

State	Code	Project
Idaho	2,3,4,8	Bannock Guard Station Stream Restoration
Idaho	4	Boisseau
Idaho	4	Brookside Hollow
Idaho	4	Burr
Idaho	10	Cedron Bridge
Idaho	6	Cedron Bridge Passage
Idaho	10	Cemetery Road Bridge
Idaho	2,4,13,16	Channel Restoration 1
Idaho	2,4,13,16	Channel Restoration 2
Idaho	5,6,10	Chester Dam
Idaho	4	City of Victor
Idaho	9	Clement Screen
Idaho	5,6,9	Clements Diversion
Idaho	9	Cole Fish Screen
Idaho	10	Cole Property
Idaho	18	Cole Property
Idaho	6	Cole Property
Idaho	9	Cole Property
Idaho	2,3,4,6	Corral Creek Dam Stabilization/Passage
Idaho	18	County
Idaho	4	Cushman
Idaho	5,9	Dewey Canal
Idaho	9	Dewey Canal
Idaho	4	Drake
Idaho	8	Duck Creek Passage
Idaho	6	Duck Creek Passage
Idaho	8	Duck Creek Passage
Idaho	4	Empey Property
Idaho	14	Empey Property
Idaho	18	Empey Property
Idaho	5,6,9	Fish Screen
Idaho	4	Flat Ranch Preserve
Idaho	6	FS 061 Culvert
Idaho	4	Gladden
Idaho	18	Harrop Property
Idaho	4	Hill
Idaho	8,15,27	Horseshoe Ck Sediment Reduction & Passage
Idaho	2	Horseshoe Ck Stream Restoration
Idaho	8	Howard Creek Passage
Idaho	8	Howard Creek Passage
Idaho	14	Hunt Property
Idaho	18	Hunt Property

Table 5-4 continued

Idaho	4	Huntsman
Idaho	6	Hwy 87 Culverts
Idaho	4,8	Jackknife Ck Comprehensive Watershed Improvement
Idaho	4	LeGaye
Idaho	4	Major
Idaho	6,8	Maytag Culvert
Idaho	4	McKibbin
Idaho	4	Mithun
Idaho	5,6,9	Parkinson Diversion 1
Idaho	5,6,9	Parkinson Diversion 2
Idaho	18	Parkinson/Briggs Property
Idaho	9	Parkinson/Briggs Property
Idaho	9	Parkinson/Briggs Property
Idaho	9	Parkinson/Briggs Property
Idaho	2,6	Passage
Idaho	2,4,18	Pebble Creek Stream Restoration
Idaho	6,9	Pump Station
Idaho	10	Ricks Canal
Idaho	4	Ross
Idaho	2,4,8	S. Fk Mink Ck Aquatic Passage and watershed Improvement
Idaho	9	Salisbury Property
Idaho	29,17	Sawtell Creek renovation
Idaho	13	Sawtell Pond Renovations
Idaho	18	Schofield Property
Idaho	6	Slash E
Idaho	9	Splitter Canal
Idaho	9	Stockon Property
Idaho	5,6,9	Stockton
Idaho	4	Stukel
Idaho	9	Taft Property
Idaho	4	Talbot
Idaho	4	Tanner
Idaho	8	Targhee Creek Passage
Idaho	10	Teton County
Idaho	4	Teton Creek Project
Idaho	1	Tetonia Canal
Idaho	5,6,9	Tom Cole Diversion
Idaho	10	Town Canal
Idaho	10	Trail Creek fish ladder repair
Idaho	10	Trail Creek Sprinkler Canal
Idaho	27	Trail Crossing
Idaho	6,8,27	Tygee Ck Passage & Sediment reduction
Idaho	6,9	Upper Diversion
Idaho	10	Upper Pump Station
Idaho	18	USFS

Table 5-4 continued

Idaho	4	Victory Ranch
Idaho	6,15	Walker Creek Headcut Stabilization
Idaho	4	West Indian Creek Trail Project
Idaho	4	Wilson
Idaho	4	Woolstenhulme
Idaho	4	Wright
Idaho	21	Yellowstone Cutthroat Interpretive Sign -- Tensleep Hatchery
Wyoming	4,3	Darby Trailhead Relocation
Wyoming	9	Hog Canal
Wyoming	2	Mail Cabin Creek Restoration

Table 5-5. Conservation projects and the specific actions that occurred within the Yellowstone GMU from 2000 through 2011. Code numbers correspond to specific conservation actions described in Table 5-1.

State	Code	Project
Montana	25	
Montana	1	Avis Ranch Instream Flow Lease
Montana	7, 17, 18, 19, 20, 22, 24, 26?	Bad Canyon Restoration
Montana	2, 12, 13	Bangtail Creek LWD
Montana	4, 18	Bangtail Mtn Grazing Allotment EIS
Montana	9, 14	Beatie Gulch Irrigation Efficiency Improvement
Montana	1	Big Creek Water Lease #1
Montana	1	Big Creek Water Lease #2
Montana	8, 9, 20, 23	Boulder River Drainage (Aller guest ranch Pond) Restoration
Montana	19	Brushy Fork of Willow Creek Restoration
Montana	1	Cedar Creek Water Lease #1
Montana	1	Cedar Creek Water Lease #2
Montana	1,5,14	Crutcher Headgate Improvements
Montana	1	CUT Instream flow Lease
Montana	3,4	Daisey Dean Bank Restoration
Montana	2,4,11	Dana-Nelson Spring Creek Rehab
Montana	8, 19, 24	Deer Creek Restoration
Montana	7, 19, 20, 22, 24, 25	Deer Creek Restoration
Montana	22	Duck Creek YCT Expansion
Montana	3,4,18	Elk Creek Bank Restoration
Montana	2,4,11,18	Emigrant Spring Creek Restoration
Montana	3	Enrico Ranch Bank Stabilization
Montana	11, 17, 20, 22, 23, 25, 26?	Goose Creek Restoration
Montana	2, 3, 4, 10, 11, 13, 17, 22	Grove Creek/Otie Lake Restoration
Montana	2, 3	Honey Run ATV Crossing Rehab
Montana	22	Keyser Creek Restoration
Montana	1	Locke Creek Water Lease
Montana	4,18	Milkovich Corrals
Montana	7	Mill Creek Barrier
Montana	1	Mill Creek Flushing Flow
Montana	1	Mill Creek Water Lease #1
Montana	1	Mill Creek Water Lease #2
Montana	1	Mol Heron Water Lease
Montana	9	Mutual Ditch Fish Screen
Montana	2, 12, 13	N Fk Willow Creek LWD
Montana	4, 18	North Bridgers Grazing Allotment EIS
Montana	11, 18, 22	Otie Reservoir Brood Pond
Montana	1,2,6	Ox Yoke Passage and Channel Restoration
Montana	13	Pine Creek Habitat Enhancement
Montana	27	Placer Gulch Stream Crossing Rehab
Montana	3, 2, 27	Placer Gulch Stream Crossing Stabilization

Table 5-5 continued

Montana	1	Purchase Cedar Creek Lease #1
Montana	4, 18	Riparian Exclosoure
Montana	4, 18	Riparian Exclosoure/Willow Planting
Montana	27	Road Decommissioning
Montana	6	Rock Creek Fish Passage
Montana	27	Shields Loop Resurfacing/BMPs
Montana	3,4	Sinnard Stream Restoration
Montana	12	Smith/Duggout LWD Enhancement
Montana	8	Smith/Shields AOP
Montana	22, 23, 25	Soda Butte Creek Restoration
Montana	7, 17, 19, 20, 22, 23, 24	Soda Butte Creek Restoration
Montana	15, 17, 20, 22, 23, 25	Soda Butte Creek Restoration
Montana	22, 23, 25	Soda Butte Creek Restoration
Montana	7	South Fork Shields Barrier
Montana	11	Spawning Gravel Placement
Montana	10	Story Diversion Passage
Montana	2, 3, 4, 12, 16	Stream Habitat Restoration
Montana	7, 17, 19, 22	Thiel Creek Restoration
Montana	2,11,12,13	Trail Creek Stream Restoration
Montana	4,18	Tubaugh Corrals
Montana	19, 20, 22, 23	Upper Boulder Restoration
Montana	19, 20, 22, 23	Upper Boulder Restoration
Montana	2	West Pine Creek Habitat Restoration
Wyoming	24	Angling Regulation for Native YCT Enhancement
Wyoming	20, 17	Dead Indian Creek YCT restoration
Wyoming	20, 22	Elk Creek Complex YCT Restoration
Wyoming	7	Ice Box Canyon Fish Barrier Project
Wyoming	19	Lake Trout Suppression for YCT Conservation on YSL
Wyoming	19	Slough Creek RBT angling and electrofishing removal
Wyoming	19	Soda Butte Creek BKT & RBT angling and electrofishing removal

6.0 Conclusions

A concerted effort has been made since 1995 to conduct robust surveys, collect genetic information and identify habitat and connectivity issues that influence the ability for the subspecies to persist. The results of these efforts continue to expand and refine our understanding so that management actions protect conservation populations while allowing diverse life histories to be expressed.

Emphasis in genetic testing has identified additional unaltered Yellowstone cutthroat trout populations, but it has also found new hybridized populations as well as previously tested unaltered populations that have now been hybridized. With over 1,800 miles of stream containing Yellowstone cutthroat trout populations remaining untested, the risk of losing unaltered populations to hybridization with rainbow trout or westslope cutthroat trout before management can intervene is high. Genetic information is critical so that decisions can be made to remove barriers to maintain diverse life histories without increasing risk of hybridization

Range-wide distribution of Yellowstone cutthroat trout distribution has continued to remain relatively constant, with less than 1 % of change between the 2006 and 2011 assessments. In addition to surveys, verification of database entries has helped the coordination team better assess current status. With this knowledge, collaborators have been able to design and implement a variety of habitat restoration projects, identify translocation sites, remove hybridizing species or prevent their spread. Almost 280 projects benefitting Yellowstone cutthroat trout have been implemented in 2000 through 2011.

In the Bighorn GMU, a reduction in the number of current Yellowstone cutthroat populations can be attributed to combining populations within the Upper Wind River HUC. There was an overall increase in the stream miles current populations reside in, mostly as a result of restoration efforts through chemical removal of nonnatives and subsequent reintroduction of Yellowstone cutthroat trout. A total of 71 projects were initiated during this time period, covering a broad spectrum of conservation actions.

Overall, the Upper Snake GMU continues to be a stronghold for Yellowstone cutthroat trout, with at least 40 actions taken during the past decade to improve their populations. Actions have included changes in regulations to habitat improvements and chemical renovations and manual removals of competing/hybridizing species. While many of these actions have not created noticeable changes in counts or mileages, they have increased the resiliency of this GMU. In the next assessment cycle, data errors identified in this process should be addressed and corrected so future actions can better identify changes that are working to improve cutthroat populations.

The review process for the Lower Snake GMU provided an opportunity for critical review of the Yellowstone cutthroat trout database. Due to the substantial number of data entry errors, few conclusions can be drawn from these data. Nonetheless, a strong effort to protect and restore Yellowstone cutthroat trout in the Lower Snake GMU indicates direct, measurable effects on Yellowstone cutthroat trout populations. Partners have enacted 97 conservation projects in the past decade. Actions have included implementation of protective fishing regulations, habitat improvement projects, fish passage and screening projects, and reclamation of streams to provide habitat free of nonnative species. Although the effects of these projects can be difficult to quantify, they have contributed to the presence of many robust populations of Yellowstone cutthroat trout in the Lower Snake GMU. Despite this considerable effort, the Yellowstone cutthroat trout populations in the Lower Snake GMU face many threats that need to be addressed to ensure that healthy, vibrant populations persist into the future. The list of accomplishments from the past decade is substantial, and conservation partners will continue to implement projects that will protect and restore native Yellowstone cutthroat trout in the Lower Snake River GMU.

In the Yellowstone GMU, comparison of occupied stream miles found little difference between assessments. Nonetheless, field surveys, genetic analyses, and rectification of errors in the database refined the understanding of the status of Yellowstone cutthroat trout in the GMU. Overall, much of the apparent diminishment in some measures of their status was the artifact of verified field data and database corrections, and not the result of actual declines. In addition, conservation actions often offset any losses of distribution or decrease in population status associated with the improved data quality. Considerable effort went into conservation, with 71 projects, usually with multiple conservation actions, occurring since 2000. Conservation projects included efforts to improve habitat and water quality, reclamation and reintroduction of populations, protection of populations, maintenance of in-stream flows, and restoring fish passage.

While the current range of Yellowstone cutthroat trout remains contracted, actions implemented through cooperative efforts have been important in conserving core populations. Continued efforts to survey and collect genetic information will guide the conservation and restoration efforts of partners, enabling them to prioritize projects and funding that protect core conservation populations throughout the remaining range.

7.0 References

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